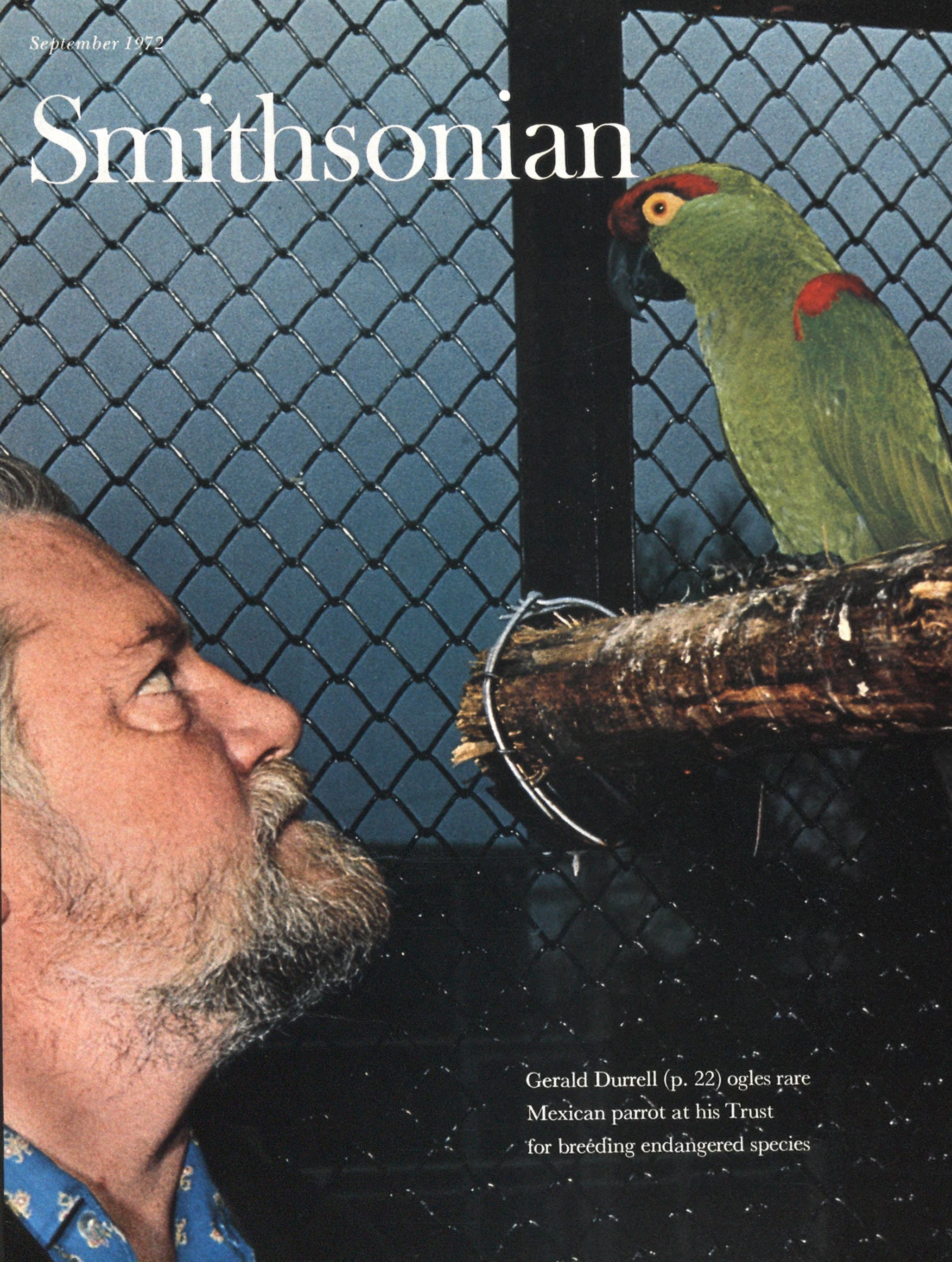
September 1972

Smithsonian



Gerald Durrell (p. 22) ogles rare
Mexican parrot at his Trust
for breeding endangered species

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Smithsonian

Volume 3, Number 6

Table of Contents

COVER: Gerald Durrell, at his Trust on the Isle of Jersey where endangered species are bred, exchanges stares with a rare Mexican parrot (p. 22)
Photograph by Terence Spencer

4 The view from the castle: Secretary Ripley advocates adoption of the metric system in the United States

6 Letters to the Editor

12 Phenomena, comment and notes: Physics tests for Einsteinians, aid for whales, peanut power and some strange examples of animal misbehavior

22 Gerald Durrell's Jersey Wildlife Preservation Trust is a home for the rare, the ugly and the irresistible
By Timothy Green
Photographs by Terence Spencer

30 A wild river is a ribbon of life
Text and photographs by Laurence Pringle

36 Ancient history now emerges from the sophisticated analysis of the Apollos' 600 pounds of moon rocks
By John Wood

44 How to look at traditional African sculpture, which Americans are beginning to understand
By Warren Robbins
Photographs by Lee Boltin

52 Plan for almost-completed Dutch defense against the sea is under fire from ecologists and fishermen, who call for a halt to final dam
By Donald Gould
Photographs by Farrell Grehan

62 A designer and fine craftsman in wood, George Nakashima, attunes his life and work with nature
By Miriam Plotnicov
Photographs by Carl Mydans

69 The remains of hunters who lay buried for 30,000 years in a cave in Spain are on display at the Smithsonian

72 We decry our problems as we plan our Bicentennial. But the America that celebrated its Centennial, 100 years ago, had the same problems—and worse
By Albin Dearing

80 Book reviews

86 September events at the Smithsonian

88 Compulsive cleanliness may send us down the drain
By Patrick Ryan

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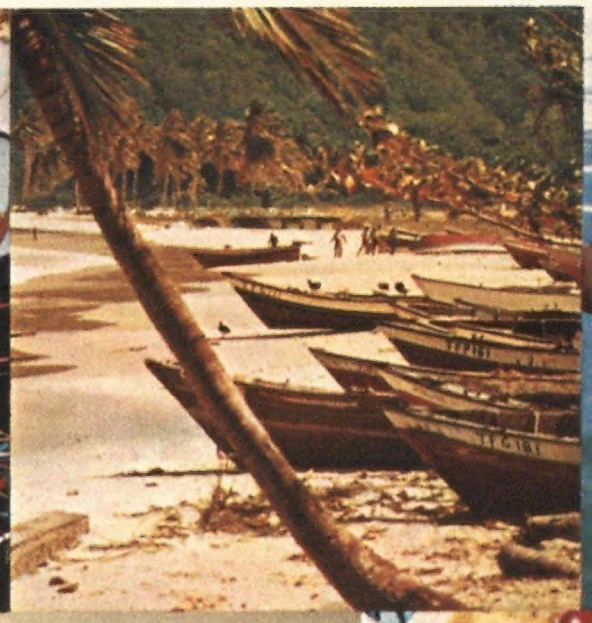

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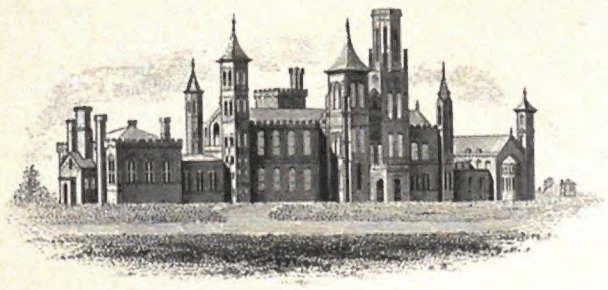
Secretary Ripley's comments

The view from the castle



The time has come for the United States to join the Western World in using the metric system of weights and measures

The problem of standard weights and measures keeps popping up in the United States with increasing frequency, and the solution is becoming increasingly clear: If we are ever going to adopt the metric system, let us get on with it.

Standardizing is especially urgent these days, partly because the United States is currently suffering from an unfavorable balance of trade abroad. It has been reported that any drop in our export of "measurement-sensitive products" such as vacuum pumps, typewriters and computers could darken the picture.

In 1969, the export of these instruments amounted to some $14 billion. Since we are in a deficit position, the loss of revenue from them would be far more crucial. Consider that the majority of nations use the metric system, and we naturally must provide them with metric instruments.

In 1866, the metric system was given legal status by Congress, but did not take the place of the old English system from which our system was originally derived. Actually, the imperial yard goes back to the Middle Ages. In 1893, the United States went off the British standard and began computing its yard and pound from metric standards. This was just as well, since the imperial yard, made of bronze, showed itself to be badly out of whack around the turn of the century—the microscopic inconsistencies are caused by shrinkage.

The standard meter is now firmly based on a specific wavelength of light which shows virtually no variation. The days of the imperial yard are numbered. Britain is committed to go on the metric system in 1975. That leaves the United States standing almost alone—we and our Canadian neighbors—still resisting full commitment to the meter.

It would seem most sensible, therefore, to declare for the metric system once and for all. In 1968, Congress passed a law directing the Secretary of Commerce to study the problem of measurements. The study recommended that the United States adopt the metric system. Currently bills have been introduced and efforts proposed to make the switch, more or less gradually, from a yardstick to a meter stick. (One meter equals a yard plus 3.37 inches.)

The easiest way to start converting would be to have hardware stores order yardsticks a meter long with the figures printed on both edges. That would explain things in the home. In time people would begin talking about centimeters instead of inches; a "foot" would come to mean only something on which you walk, rather than that untidy unit of measure which got going in the dim past. All planners, economists and research workers in this country would applaud such a sensible change, not least our Smithsonian scientists who, like the rest of the scientific community, have been educated to use the metric system.

The framers of the Constitution recognized the importance of a uniform system of measurement and expressly gave Congress the power to "fix the standard of weights and measures." Now is the time to begin the arduous but necessary task of converting our archaic and chaotic system of measures to the metric system which is in almost universal use. For once, quaint historic charm should give way to common sense.

S. Dillon Ripley

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Letters to the Editor

Tsavo Elephants

Dear Sir: I wonder how many North Americans reading your article, "Too many elephants: They can be shot or allowed to starve," realize that you can substitute "elk" for "elephant" and write almost identical articles. The following quotations from your article, when applied to the elk, show what a strong parallel exists:

- They are so grand, they seem so self-sufficient. Left alone they are harmless . . . yet even in the sanctuary of a national park, Man does not seem able to do right by them.
- Once they roamed the entire continent [but they have] been jostled along to make way for agriculture. . . .
- Now there are probably about 500,000. . . . Most of these are in the national parks. . . .
- If the habitat is to be preserved in its present form . . . the numbers . . . will have to be controlled.

Alan A. Beetle
Professor, Range Management
University of Wyoming
Laramie, Wyoming

Dear Sir: To update my article on Tsavo elephants, I have learned that National Park officials now assert that "more than 4,000 but not more than 5,000 elephants died during the drought." Other experts claim that the figure must be well over 5,000. No one denies anymore that one-third of the Tsavo East population died.

In the reference to a 1963 survey of elephants in Tsavo East Park, you have attributed the study to Dr. Phillip Glover rather than to James Glover. Dr. Phillip Glover has been serving with the Tsavo Research Project since 1968. The results of James Glover's Tsavo study were published in the *East African Wildlife Journal* for 1963.

John Reader
Nairobi, Kenya

Pupfish

Dear Sir: As the photographer who illustrated the precarious plight of the pupfish *(Cyprinodon diabolis),* I have learned of some encouraging news. The Bureau of Reclamation is constructing a refuge for the pupfish about a quarter of a mile below Hoover Dam on the Nevada side, an area containing several warm springs with water similar to its natural habitat at Devils Hole. This man-made refuge will have a deep end and a shallow shelf and will provide the same angle of sunlight. The Bureau of Reclamation expects to complete construction late this month and plans to stock the refuge during October.

Rulon I. Hancock
Salt Lake City, Utah

Dear Sir: You may be interested to know that I have been taking a monthly census of the Devils Hole pupfish for the National Park Service, and my fourth and latest report is discouraging. A study of Devils Hole has shown that a secondary spawning normally takes place in late July, but on July 28-29 there were no newborn young and the population was a stable 300—50 percent below normal for this time of year. The natural shelf, which supports the green algae they feed on and is their spawning ground, is only five percent below water, and the artificial shelf does not seem to have sufficient algal growth.

Twenty-five pupfish transplanted to an artificial environment three miles north of Devils Hole apparently have been victimized by predators and are not spawning. Thus, in 20 years, no transplant or culture experiment has succeeded. It seems clear that there is only one way to assure the survival of the Devils Hole pupfish, and that is to restore its natural habitat, although I hope the Hoover Dam project succeeds.

Robert Rush Miller
Professor of Zoology
University of Michigan
Ann Arbor, Michigan

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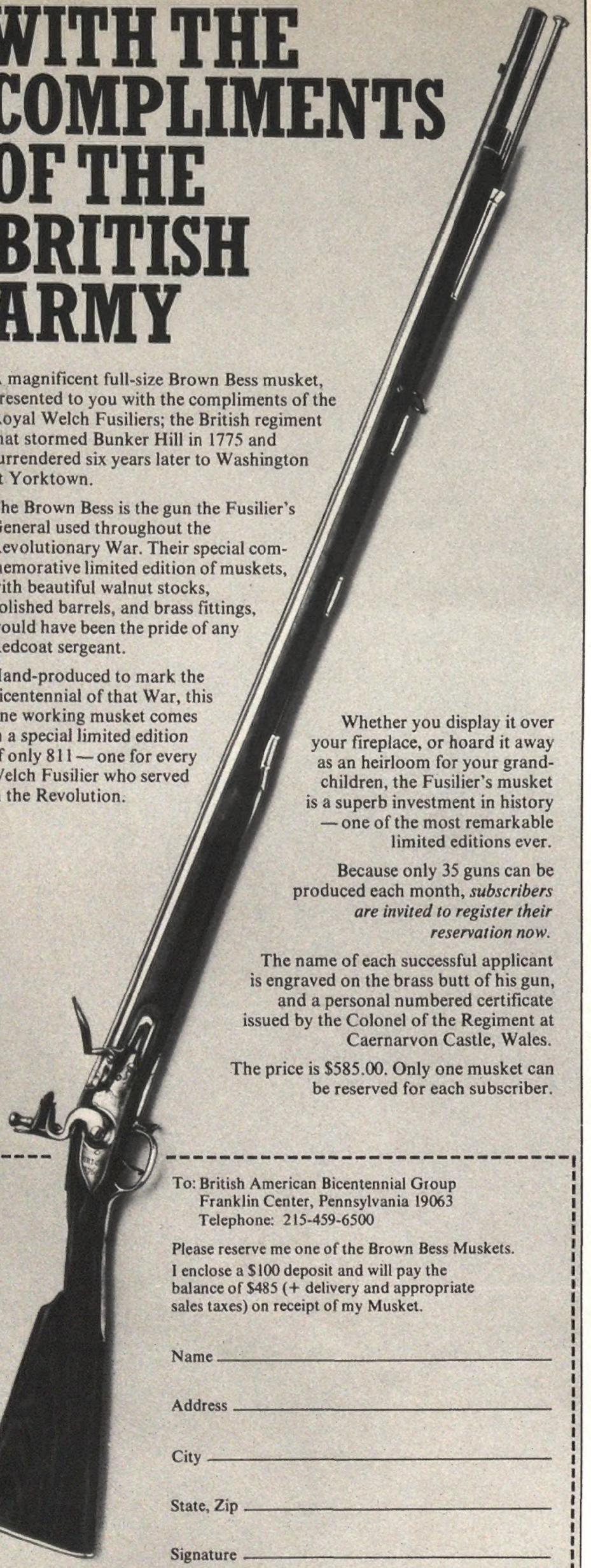

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Merry-go-rounds

Dear Sir: Regarding merry-go-rounds in the July issue, I disagree with you on one point. The animals on the merry-go-round at Fun Forest in Seattle were carved by M.C. Illions. He carved his self-portrait on one of the horses.
Eric Cisney
Seattle, Washington
Author Barbara Fahs Charles reports that there are figures on the Fun Forest merry-go-round by M.C. Illions, the Looff factory and George Carmel. The portrait (see below) is not of Illions, but one of Abraham Lincoln. Illions used the Lincoln penny for a model. Ed.

Noise

Dear Sir: Apropos your article on noise, I would like to comment on my own experience. As the result of a mastoid operation, I am almost totally deaf in one ear. Now, at 67, I find it is simply great to have one deaf ear, for when the blue jays start screaming at 4:30 in the morning and the planes from Logan Airport begin to fly over our house, I just turn over on my "good" side.
Mrs. Haven Parker
Cambridge, Massachusetts

'Summer School' paintings

Dear Sir: Your article, "A halycon summer that lingered on and on—in painting," brought back many memories.

I was born in 1892 and we *always* went to the exhibitions of paintings at the Carnegie Institute in Pittsburgh from the time I was eight or nine years old. I have just been rereading the 1902 catalog, and it records that medals were given to Childe Hassam (1898), Frank Benson (1896, 1898 and 1902), J.H. Twachtman (1899), Edmund C. Tarbell (1901, 1902).
Mrs. R.H. McGraw
Freeport, Pennsylvania

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Short-lived phenomena

Dear Sir: In regard to your item on "Russian ingenuity," you might be interested to know that the carving by Nikolai Syadristy of shoes for a flea was inspired by Nikolai Leskov whose story, "The Steel Flea (The Tale of the Cross-Eyed, Left-Handed Gunsmith from Túla and the Steel Flea)," was published in 1881. The satirical story tells of a similar carving in the reign of Nicholas I.
Gerald J. Gallagher
Drexel Hill, Pennsylvania

Dear Sir: In respect to your item, "Combating bat bite," this may turn out to be another repeat of history. It seems to me that if the vampire bat remedy is applied, it would cure man of *Desmodus rotundus* for good. Do we not have enough species on the endangered and extinct lists?
Mark Fleming
Mulvane, Kansas
One might also have worried about Norway rats when the anticoagulant Warfarin was developed, but researchers have recently found a strain of rats in the South that has developed a resistance to it. Given the fact also that the bat scheme is to be applied locally, one need not fear excessively for the bats. Ed.

Pandas

Dear Sir: Your panda article in the June issue was delightful and informative. After visiting our furry Chinese friends at the National Zoo, I have one question. Why are the pandas being kept in separate enclosures?
Joan M. Davenport
Washington, D.C.
If the older, and now larger and more aggressive, female were to be put in actual contact with the male, she might assume a dominant role that would be permanent. Thus, a few years from now when it is time for the pandas to mate, the zoo officials might have a timid and subservient male. Ed.

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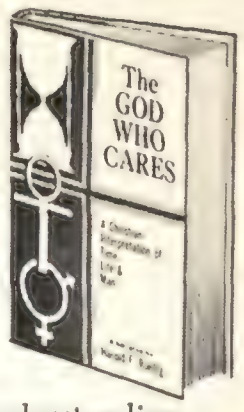

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Phenomena, comment and notes

Physics test for Einstein's theory, aid for the whales, peanut power and some cases of animal misbehavior

People who look to nature to back up their ethical systems often contemplate the relations between predator and prey as paradigms of fairness. The tiger grows hungry, chases and kills a buffalo and waits until it is hungry again to attempt another kill. If there are too many buffalo, there will soon be more tigers, leading to less buffalo and so on—justice and population control all calibrated like a finely tuned clock. Only brutish man, say some conservationists, has become derailed from the just and true track of evolution and careens around his ecosystem, wantonly killing for the sake of it.

Regrettably, moralists will have to seek another model.

In the *New Scientist,* Hans Kruuk, an Oxford biologist, describes instances of wanton slaughter on the part of wild carnivores. He once counted 1,449 adult gulls, plus their young, massacred overnight (but most remained uneaten) by foxes on a beach in Northern England. Another such incident occurred in the Serengeti Plains of Tanzania. In one night, spotted hyenas slaughtered 82 gazelles and in the morning Kruuk found injured gazelles staggering in circles or standing dazed among the dead.

It had been an especially dark night and Kruuk's subsequent detective work showed that the hyenas had strolled quite leisurely through the herd, dispatching gazelles at will. The gulls had also met their fate on a dark night.

Such events may do little for the con-

cept that the meek will inherit the earth: To Kruuk they seemed to be biologically unadaptive. Would not such behavior lead to the ultimate extinction of prey and, hence, of predator?

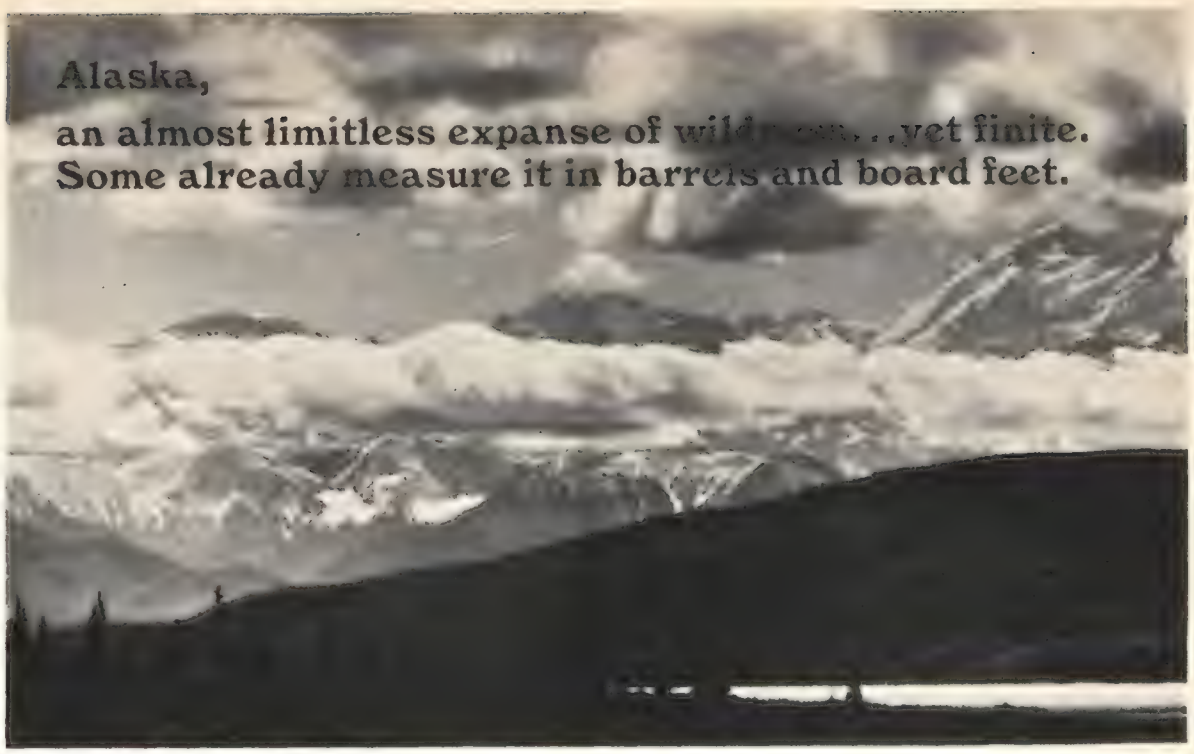
In fact, carnivores often kill more than their immediate necessities. Those running in packs and herds may kill enough for their colleagues. Others will stow some of the excess for future use. But such was not the case in these two massacres any more than it is true in the far more common violence unleashed by a fox in the hen house.

Kruuk suggests that on especially dark nights it is less dangerous for certain animals to flee than to stay put. As for the predators, he says that once satiated they are invariably inhibited from using up the great amounts of energy needed to *chase* prey. But they are not inhibited from simply killing whatever else is readily available. Predators, therefore, evolved a mechanism to conserve energy but none that directly inhibits them from killing more than they need. Such an admirable mechanism, writes biologist Kruuk, "may be too much to ask for carnivore evolution; it should not be too much to ask from man."

Troubles in Spain

Speaking of foxes, which may well need a champion after this month's news, the Center for Short-lived Phenomena has received word that there are simply too many in the Spanish province of Oviedo. In fact, there are about 100,000 remaining after several relatively unsuccessful efforts to reduce the population. This horde is now on the verge of exterminating the capercaillie (a member of the

The capercaillie, stuffed in the Smithsonian, outfoxed in Spain.



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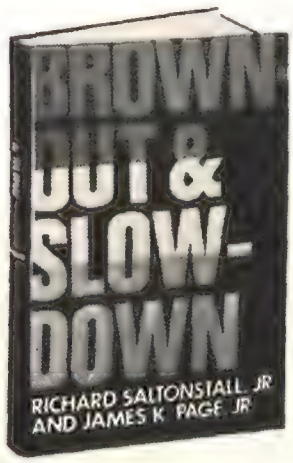

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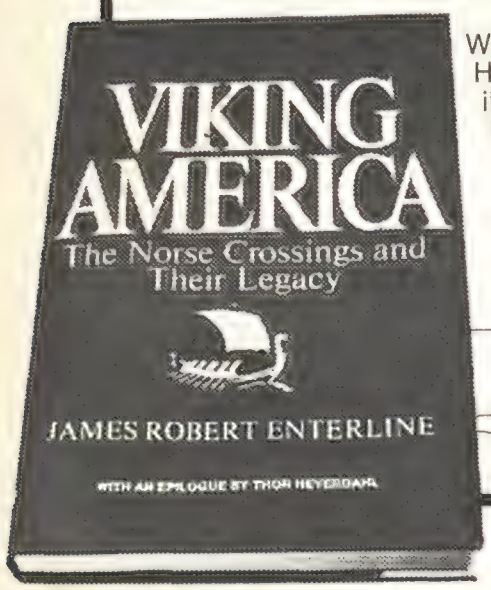

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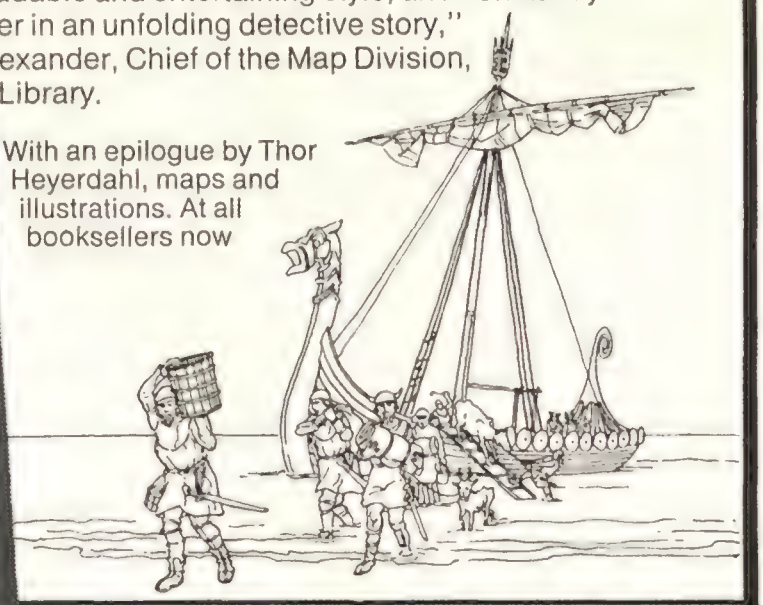

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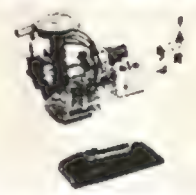

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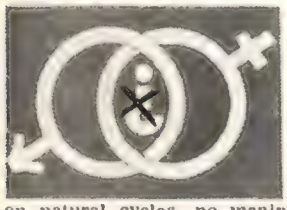

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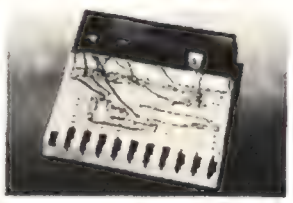

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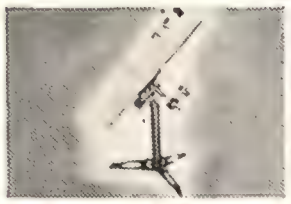

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grouse family), of which there are only 1,000 left in Oviedo.

"No formal investigation is expected," says the Center's informant.

When it comes to olives being threatened, however, Spain leaps into action. The Center reports that no less than ten other provinces are suffering a plague of another sort: the olive fly. Lest olive farmers and some martini drinkers be wiped out, Spain's Ministry of Agriculture has declared that all the affected zones should be sprayed from the air with insecticide.

A test for Einstein

Practically all of us have a sense of physics, regardless of how much of it we once learned formally and have since forgotten. Pool-shooters have a feel for force, mass and acceleration and regularly make use of vector analysis of a sort. People who climb stairs, ride elevators and take off in planes can feel gravity. It is a sensible Newtonian world we inhabit.

It is much harder to understand (and most of us don't) when post-Einstein physicists tell us that gravity affects time; that, for example, if two identical clocks were placed in two locations in which the gravitational pull is different, the rates of the clocks would appear to an observer to be different.

Not only do we not understand that, we are inclined not to believe it. Indeed this aspect of the Theory of General Relativity remains theory, yet unproven.

Sometime in 1974 the Smithsonian Astrophysical Observatory in Cambridge, Massachusetts, under a grant from NASA, will provide a direct test. One of two identical and highly stable clocks will be launched over the Atlantic aboard a suborbital rocket. The other will remain on the ground in Bermuda. The relative rates of the two clocks will be compared by telemetry over various distances and gravitational conditions to an altitude of 11,000 feet.

At that altitude, according to Einstein's theory, the rocket-borne clock should run faster than the ground-based clock by about five seconds in 360 years. That's a pretty small effect—not even Willie Hoppe would have been aware of it if it applied to his billiard table. But the clocks being developed by the Smithsonian should be able to sense the difference with ease. They are atomic hydrogen

Maser bulb is component of "clock" designed to test Einstein.

masers, machines in which the electron and the proton in the hydrogen atom generate a microwave signal. This signal is so stable that it is equivalent to a clock that loses less than two seconds every 100 million years.

Tornado psychology

Insurance companies refer to tornadoes as "acts of God," and the extent to which you take that description seriously may have something to do with your chances of surviving a tornado.

At least such are the findings of a psychiatrist from the University of Chicago, John H. Sims, and a geographer from Southern Illinois University, Duane D. Baumann. They were struck by statistics showing that five times as many people in the South are killed by these violent storms as in other areas. Yet the "casualty potential" of the South is nowhere near five times that of other regions.

Tornadoes, the two researchers wrote in *Science* magazine, are no more likely to strike at night in the South, nor are they more violent. They ruled out substandard housing which is more common in the South, suggesting that in some cases an insubstantial house may be *safer* than a more solidly built one. Tornado warnings are equally available to all.

A questionnaire, administered to 56 people in comparably tornado-prone counties of Alabama and Illinois, led the researchers to the conclusion that one's attitude may have a great deal to do with

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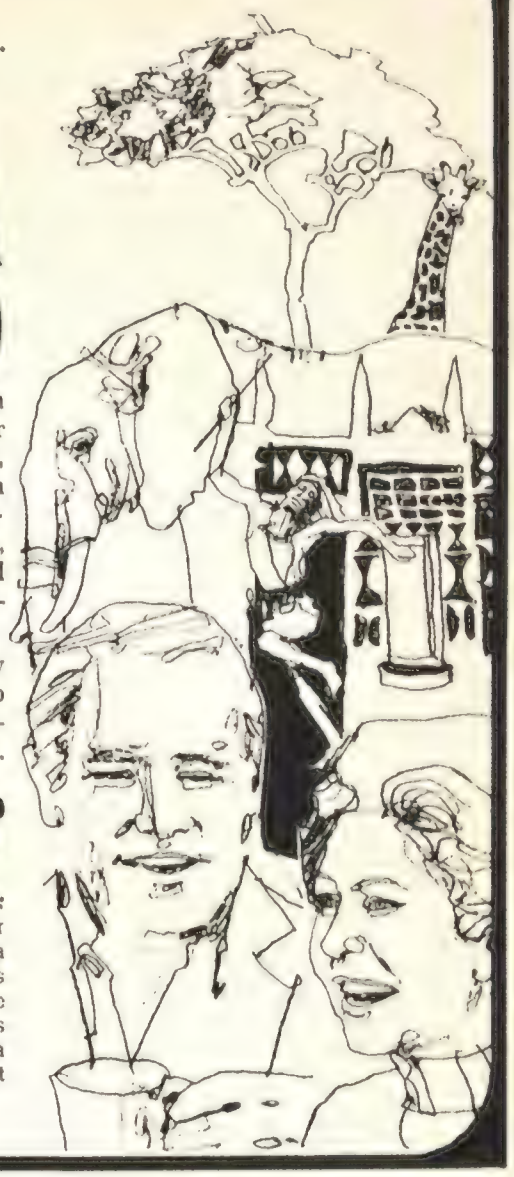

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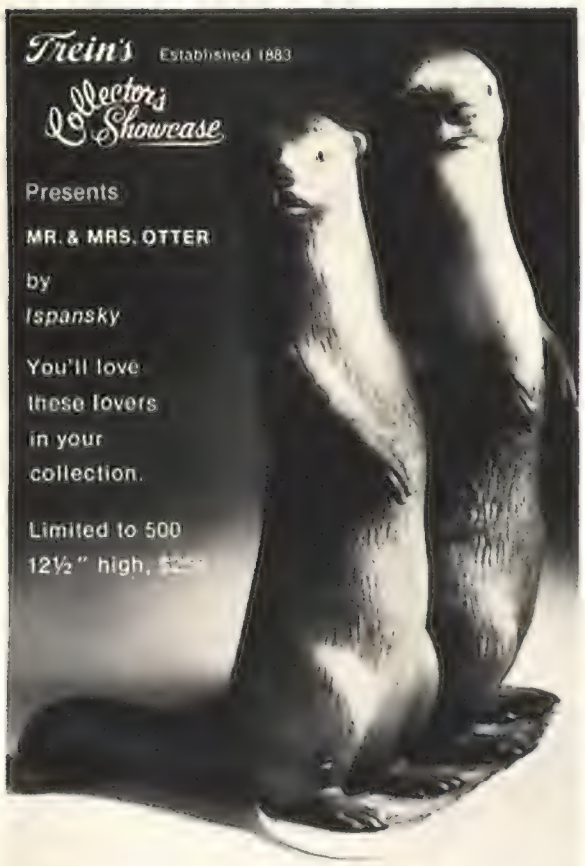

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it—specifically, one's attitude toward technology, luck and God.

They found that people (like most of the respondents from Alabama) "who believe that God (or fate or luck) controls their lives, who have less confidence in their ability . . . to effect change . . . place less trust in man's communal knowledge and control systems; they await the fated onslaught, watchful but passive." On the other hand, most of the respondents from Illinois see God as playing a less active role in their daily lives. They see luck as random chance, rather than a matter of destiny, and apparently they are therefore more inclined to place faith in man's early warning technology and take evasive action.

A blow for whales

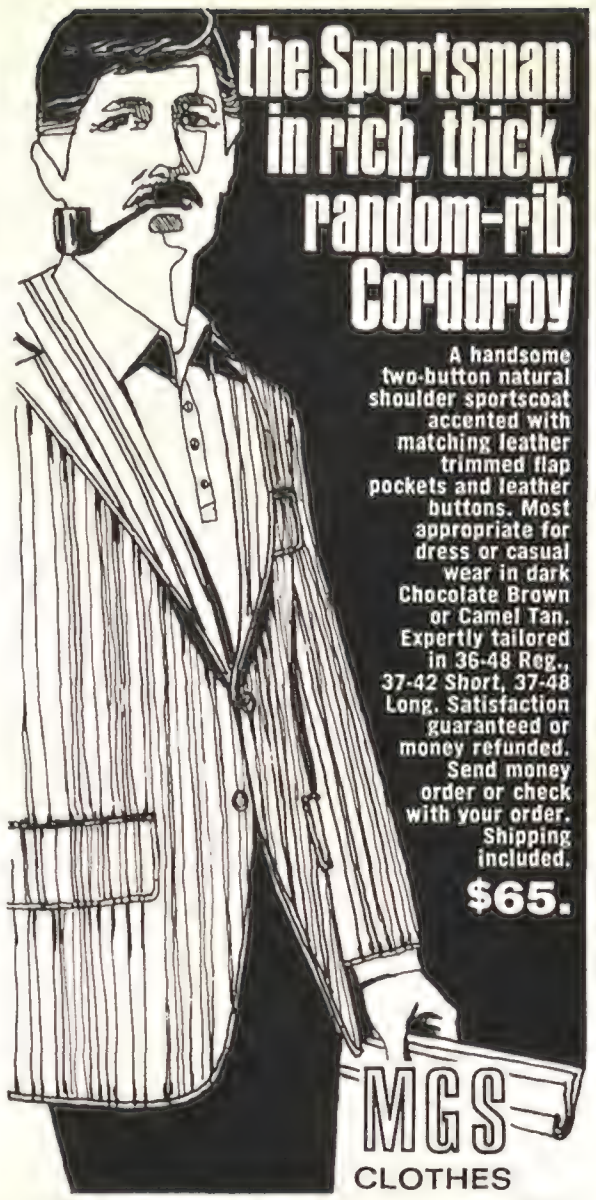
It took about one month for one of the major recommendations of the United Nations Conference on the Environment to go to its grave. In June the U.N. delegates in Stockholm asked for a ten-year moratorium on all commercial whaling during which a large-scale program of research into the status and future of whales could be conducted.

In early July the International Whaling Commission met in London, and the United Kingdom and the United States (which has already virtually extinguished its whaling industry) formally proposed the moratorium. Four other nations joined Japan and Russia (who account for about 80 percent of the annual catch) in rejecting the idea.

Instead, the IWC extended its quota system from Northern Pacific whales to those in the Southern Hemisphere and refined the system, establishing quotas on both males and females of given species. This is considered a step forward since the ratio of males to females can be as crucial in whales as in many other populations. The IWC agreed that a ten-year research program into cetaceans was desirable and this will probably begin by next summer.

Some U.S. advisers to the commission saw it as another forward step when the commission set its quotas (for the first time) in line with the recommendations of its own scientific committee. In the past, quotas have been set in excess of the scientific recommendations.

Many whale-watchers, however, were unimpressed with these forward steps.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One conservation group, the Friends of the Earth, considered the rejection of a moratorium as a major setback. One ecologist in the U.S. government complained that the IWC operates on a "fisheries" psychology inappropriate to the long-lived whale: "When you're talking about fish, you're talking about short time spans. A mistake in your judgment or an environmental problem shows up quickly and can be remedied quickly. Whales are mammals, not fish. It can take a longer time to see a problem developing, and by then the remedy may be too late. The whales are going to be in trouble until the Commission gets rid of its fisheries mentality."

Peanut power

Peanuts are inclined to disappear quite rapidly, even in the presence of weight-watchers, but the peanut shell is quite a different matter. Over 1.5 million tons of peanuts are produced each year in the United States and one-fourth of that tonnage is hulls. Once they were used as filler for fertilizer but that market dried up with the advent of liquid fertilizers. Open burning causes air pollution. In Georgia, which produces half the nation's peanuts, hulls must be thoroughly ground up or burned before they can be used as landfill: a costly but necessary insect control measure.

One answer to the hull headache is to be found in a Columbus, Georgia, peanut processing plant. The hulls are simply burned in a steam-producing boiler and, according to *Environmental Science and Technology*, the resulting steam provides enough power to run half the operation of the plant. Peanut hulls "have two-thirds the heating value of coal and one ton of peanut hulls is equivalent to 20,000 cubic feet of natural gas."

Another scheme, recently developed by engineers at Georgia Institute of Technology is a "portable" machine that could be shared by Georgia's many small peanut-shelling concerns. It converts 50 tons of hulls a day into gases (which can be used as fuel, rather like natural gas) and high-quality char. The char, say the engineers, could then be sold for the manufacture of charcoal filters, specialty carbons and even charcoal briquettes. George Washington Carver, who himself created some 300 products from the versatile peanut, would be delighted.

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By Timothy Green

Gerald Durrell's home for the rare, the ugly and the irresistible

An inveterate animal collector and famous author converted the zoo in his luggage into a park for breeding of endangered species

"The trouble with me," said Gerald Durrell (see cover) puffing hard on his Gauloise, "is that I was born with this thing about animals and, being quite uneducable, the only job I could ever do was animal collecting." From earliest childhood he was a Pied Piper to the animal kingdom—a walking menagerie with field mice, toads or grass snakes overflowing his pockets. Even then Durrell had a single ambition: One day he would have his own zoo.

Many forget their childhood dreams, but Durrell has never wavered and today he presides over a unique zoo in the little village of Trinity on Jersey in the Channel Islands. What distinguishes his zoo, the Jersey Wildlife Preservation Trust, from most others is that it has been conceived from the beginning to fulfill a special task—the breeding in captivity of species threatened with extinction.

Every visitor to the zoo is instantly reminded of this by a large replica of the dodo, prominently displayed by the entrance. "Once there were vast numbers of Dodo birds," Durrell has written on a sign beneath, "civilised man killed them all—not one remains alive. . . . Many other animals may be as Dead as the Dodo unless we protect them." Around the zoo, a small, red plaque of the dodo is fixed to every cage that holds an endangered species, a reminder that the animal or bird within is also threatened with extinction. The zoo's cable address is also, appropriately, DODO, Jersey.

"I got desperate at what I saw going on all over the world," Durrell says. "The forests were being chopped down and new Sahara deserts were being created in their place. I became increasingly depressed—and angry too—at the way zoos neglected many threatened species. Everyone loves to put up money to save a giraffe, but not for some obscure, cross-eyed little animal with a snub nose. But ugly ones have just as much right to be saved as a giraffe—and more right than the average politician. Take the solenodon from Cuba and Haiti—it looks rather like a large rat, with beady eyes, heavy claws and a naked, scaly tail. Not an animal many people want to cuddle, but I believe they deserve to be preserved."

Durrell's ire was further roused at the fate of many of the rare species that he did bring back from his forays to odd corners of the globe. "When I was in the tropics collecting animals I used to put them in little wooden boxes to bring them home. I looked after them carefully and sometimes they would even breed in those boxes. I'd get them back to the zoos in perfect condition. Two or three weeks later I'd go to the zoo to see how they were getting on and their cage would be empty. 'What happened?' I'd ask. The zoo would say, 'Oh, it's dead. It can be very difficult to keep some animals, you know.' But I was convinced that if I could keep them and breed them in a box, you certainly could in a zoo."

"In the end," Durrell says, "I got so fed up I decided I'd give up animal collecting, unless I could have my own place—a zoo that would both interest people and, most essential, save animals. I see no justification for keeping animals in cages, unless it is for the benefit of mankind or to help the animals."

One of Durrell's 37 very rare white eared pheasants inspects her latest contribution.

Photographs by Terence Spencer

Durrell's home for the rare

Pedro, a lovelorn spectacled bear from the Andes, awaits a well-heeled matchmaker.

But where does one start a zoo? "I'd come back from the British Cameroons with everything from chimps to cobras and for a while I had to park them in my sister's back garden in Bournemouth while I looked for a suitable place."

His natural enthusiasm which requires that everything be done today—if not yesterday—soon fell foul of British red tape. No one was ready to grant him instant permission to found a personal, private zoo. "I got browned off with muddleheaded mayors, half-witted subcommittees and the masochistic way the British love to stop each other getting anything done," he recalls. "Winter was coming on and I had to get the chimps and cobras out of my sister's garden. So I said to my wife Jacquie, 'For Christ's sake let's go somewhere where there aren't so many rules and regulations.' She said we had a choice of two places—the Isle of Man or the Channel Islands."

The Channel Islands have the advantage of better climate and their situation, being a mere stone's throw from France. He chose them without hesitation. Through his publisher in London, Durrell obtained an introduction to Major Hugh Fraser, who lived in a 15th-century manor house, Les Augres Manor, on Jersey. Fraser readily offered to help in the hunt for a likely site, and Durrell flew over for lunch one day. As they strolled around the grounds of the manor, with its old stone stables and rambling parkland, Durrell suddenly said, "What a marvelous place for a zoo."

"I thought Fraser might go white and faint," he recalls now with pleasure, "but he simply said, 'Are you serious? Would you like to rent it? It's too big for me.' Within a couple of weeks it was all worked out."

So in 1959 Durrell became not only zoo owner but Lord of the Manor of Les Augres. The manor and its 40 acres of park have proved as adaptable to a zoo as Durrell anticipated that first afternoon. The old stables, dating from 1795, have been converted into the mammal house. Two Bornean orangutans, Oscar and Bali, occupy the ground floor with their daughter, Surabaja, which was born at the zoo in April 1971. Above, red-handed and saddle back tamarins and mouse lemurs are in residence.

A stream lazing through water meadows in a valley below the house has been dammed into a series of ponds, which are now bustling with Hawaiian geese, Cape Barren geese, Laysan teal, Chilean flamingos, saddle billed storks, Kavirondo crowned cranes and a productive pair of snowy owls (see page 29). On an open stretch of park, a new enclosure houses Pedro, a spectacled bear from the Andes mountains of South America. Outside his compound a plaintive sign requests help in finding Pedro a mate (above).

Jersey, itself, has proved to be the haven from bureaucracy Durrell sought. "The beauty of the island is that rules and regulations are minimal," he says happily as he prowls his domain. "You can pick up the phone and speak directly to the man in charge. We have even received help and encouragement from the bailiff himself, the local prime minister. As it happened he's an animal lover and from the beginning he thought the zoo was a marvelous idea. So, bang, we had the stamp of approval—provided, of course, that we didn't let lions rush loose all over the island eating the Jersey cows."

Author of books on gold, smuggling and television, Mr. Green reported in SMITHSONIAN*'s June issue on Britain's exhibition of Tutankhamun's treasures. Mr. Durrell's brother, Lawrence, is the novelist.*

The islanders have accepted the zoo in their midst with great equanimity. When a tapir escaped one stormy night and went gallivanting through carefully cultivated fields there was hardly a murmur of protest. The zoo's neighbors even learned to sleep through the roaring of a lion that insisted on exercising its vocal cords at 4:30 each morning.

When the Trust decided in 1970 to purchase the whole property, instead of renting, the local parliament of Jersey at once put up a loan on easy terms for half the purchase price. "The island," Durrell reports, "is with us all the way."

In the early days the zoo had to be what Durrell calls "a stamp collection"—a wide selection of popular animals to attract the public. Without their support the zoo could not prosper. "But once we had the gate money coming in and made it viable," Durrell explains, "we turned it, in 1963, into a scientific Trust with the purpose of building up breeding colonies of mammals, birds and reptiles whose numbers are so reduced in their normal habitat that they can no longer cope with the natural hazards of their environment as well as with advancing civilization. We are now honing down the collection and in four or five years it will consist only of endangered species."

All this costs money. "The going rate for an adult gorilla may be $7,800," Durrell points out, "and then you have to spend thousands more housing him." But he has never let lack of money come between him and an animal or bird he wants. "The trouble is," he admits cheerfully, "I have a butterfly mind. I wake up in the morning and say to myself 'Durrell, you must concentrate on mammals.' Then someone rings up and says 'I've got a ring-necked toonwhistle from Madagascar, it's a beautiful thing with a purple beak and green wings.' I can't say no."

When Durrell was in New Zealand making a television film he was invited to lunch by several government ministers. "The minister in charge of animals asked me, 'Can we give you something for the Trust?' So I said, 'Yes, a pair of tuatara'—that's a very rare lizard found only in New Zealand. Now I knew that the New Zealanders allowed out four or five a year but each went to a different zoo. I said to the minister, 'I want a pair, I don't want one. It's a mad policy to let single tuatara out; you might as well stuff them now and put them in a museum. Let me have a pair and they may breed.' He agreed and even changed the whole policy, so that tuataras may leave in pairs."

So far the tuatara couple at the Jersey Zoo have not bred, but they are relative youngsters and the tuatara are reputed to live for 150 years.

The zoo has been more successful with the white eared pheasant (p. 22). These rare birds were found only in China and Tibet, where they may now be extinct in the wild. Until 1968 the only ones known to be in existence were in the Peking Zoo and there had been no fresh information on them since before World War II. Then one day John "Shep" Mallet, the curator of birds at the Jersey Zoo, burst into Durrell's office.

A second pair for insurance

"He was white and stern," Durrell remembers. "I thought at least the birdhouse had burned down. 'Have you seen this Antwerp dealer's list?' he asked. 'There are four pairs of white eared pheasant he's got from Peking.' " Now Shep had done such a fine job breeding other birds that I'd told him that the next time there was a bird he really wanted I'd buy him a pair. He phoned the dealer in Antwerp—his hands were shaking he was so eager—and found out they were $650 each. So I agreed at once I'd buy a pair. But after he'd put the phone down Shep kept pacing up and down and finally he said, 'I've been thinking, Mr. D [everyone calls him Mr. D], our having just one pair—suppose anything happened to one of them? Would you be willing for me to buy another pair out of my savings?' So we bought a pair each."

They have been well satisfied. The white eareds have bred so well that the zoo now has the largest collection outside China (and possibly in the world). The first year when they were uncertain whether the pheasants were laying, Shep Mallet spent days on his hands and knees in their pen sifting the sandy floor in search of eggs. Eventually he found a clutch of six carefully concealed in the sand and put them under a bantam to hatch. By the end of 1971, 35 white eareds had been

The African serval (above) is endangered, as are most of the cats, but has taken well to Jersey.

A near casualty in Madagascar, this mongoose lemur and Durrell's five others have not as yet bred.

successfully reared, and 11 of them loaned out to specialist collections in France, Belgium, England and the National Zoological Park in Washington, D.C., against the possibility that an epidemic might hit Jersey. (Mr. D will not sell any of his white eareds—he only lends them.) With the prospect of having 70 white eareds after the 1972 breeding season, Durrell is eager to establish relations with the Chinese. "It would be ideal to return 20 or 30 of them to their original habitat in China and Tibet," he says. But thus far all his proposals to Peking have met with silence.

The size of the Trust's collection of white eared pheasants prompted a German zoo director, whom Durrell was showing around recently, to remark: "I admire your audacity. I know of no other zoo that would put six cages of white eared pheasants side by side. Any other zoo would say, 'We've got one pair, we might as well sell the others.' " That is precisely why Durrell's zoo is unique. "What I'd like to have in the future," Durrell says, "is six times as many of half the species we have now."

Durrell likes nothing better than dashing off on expeditions of his own in search of rare animals for his zoo, and many of these animals appear not only at the zoo but in Durrell's many yarn-filled and often hilarious books. In *A Zoo in My Luggage* (Viking Press), Durrell writes of a tame female baboon named Georgina which he bought in what were then known as British Cameroons for his monkey collection. Georgina had "a wicked sense of humor," as Durrell's secretary Sophie found out while taking a bath in camp.

"Unfortunately, as she soon discovered, Sophie had not shut the door properly. Georgina had never seen anyone bathe before, and she was not going to let such a unique opportunity pass without taking full advantage of it. She hurled herself against the door and threw it wide open. Sophie now found herself in a predicament; she was so tightly wedged in the bath that she could not get out and shut the door without considerable difficulty. . . . With a great effort she leaned out of the bath and reached for her clothes, which she had fortunately placed nearby. Georgina, seeing this, decided that it was the beginning of a promising game; she jumped forward, clasped Sophie's raiment to her hairy bosom, and ran outside with it. This left only the towel. Sophie struggled out of the bath, draped herself in this inadequate covering, and having made sure that no one was around, went outside to try to retrieve her garments.

"Georgina, seeing Sophie was entering into the spirit of the game, gave a chattering cry of delight, and as Sophie made a dart at her she ran back into the bathroom and hurriedly put Sophie's clothes in the bath. Taking Sophie's cry of horror to be encouragement, she then seized the tin of cigarettes and put that in the bath too, presumably to see if it would float. It sank, and forty-odd cigarettes floated dismally to the surface. Then, in order to leave no stone unturned in her efforts to give Sophie pleasure, Georgina tipped all the water out of the bath. Attracted by the uproar, I appeared on the scene just in time to see Georgina leap nimbly into the bath and start to jump up and down on the mass of sodden cigarettes and clothes, rather after the manner of a wine-treader. It took considerable time to remove the excited baboon and get Sophie fresh bath water, cigarettes and clothing, by which time the dinner was cold."

Elsewhere Durrell describes a black-eared squirrel

named Small which slept in a "biscuit tin by our bed. She would awake early in the morning and, uttering her loud cry, would leap from the tin onto one of our beds and crawl under the bedclothes with us. Having spent ten minutes or so investigating our semi-comatose bodies, she would jump to the floor and go on an expedition on the veranda. From these expeditions she would frequently return with some treasure she had found (such as a bit of rotten banana, or a dry leaf, or a bougainvillaea flower) and store it somewhere in our beds, getting most indignant if we hurled the offering out onto the floor. This went on for some months, and then came the day when I decided that Small would have to occupy a cage like the rest of the animals, for I awoke one morning in excruciating agony to find her doing her best to stuff a peanut into my ear."

One of the most successful of Durrell's collecting forays was a trip in 1965 to Sierra Leone in search of black and white colobus monkeys. Although the colobus is not yet a rare animal, its future is threatened as hundreds are killed every year in monkey drives in West Africa in an effort to cut down on forest damage. Durrell established himself for the enterprise in a rather splendid base camp in a deserted chrome mine. "I had a bungalow with a veranda looking out to the mountains of Liberia and we even cleaned out the old swimming pool. It was like having a township all of your own."

The expedition got off to a somewhat hair-raising start when two young leopards that Durrell had acquired earlier in the expedition broke out of an outhouse, where he had put them for the night, terrifying a British television crew who had just arrived to film the colobus monkey capers. "They'd hardly unpacked their bedsocks," Durrell recalls delightedly, "when they came rushing up, white with fear, to say that a leopard was snarling on the roof."

Smoking out the colobus

Having corralled the leopards, they sought the advice of the local Africans on catching colobus. "They have a method," Durrell explains, "which I'd always believed was an old wives' tale. Two or three hundred of them go rushing through the high, thick rain forest driving the monkeys before them into the secondary growth trees at the forest's edge. Then they encircle them and gradually close in by chopping down all the surrounding trees. Eventually all the monkeys are in one tree. Then they build up what they call a coup (a pile) of branches down below, cut down the tree and the monkeys come tumbling into it. That's how we caught the colobus. We had 250 Africans all giving each other orders at once and making a spectacular noise. This soon frightened the colobus into one tree.

One of two born at the zoo, a South American tapir inspects Cape Barren geese that invaded its pen.

A staff member wields two recent arrivals, a couple of so far unpaired Rothschild mynahs from Bali.

Durrell's home for the rare

Then the Africans tried to cut it down with a saw that was at least 300 years old; the saw had no effect. So I said why not light a small fire and smoke them out? As soon as the smoke drifted up they came tumbling down into the branches which were surrounded by our nets."

Seven colobus were taken back to Jersey, where they are established as two family groups. Twelve babies have been born (including male twins in 1970) and six reared successfully.

Along with the colobus, the zoo is building up an impressive record of other rare species breeding in captivity. A pair of *Macropus parma* or white-throated wallabies, which are already extinct in Australia and are thought to survive in the wild only on Kawau Island, off New Zealand, are rearing a shy youngster born in 1970. African civets are thriving on Jersey and two types of tenrec, the pygmy hedgehog tenrec and the spiny hedgehog tenrec found only in Madagascar and the Comoro Islands nearby, have taken so readily to Jersey that almost 40 have been reared. Durrell hopes that three pairs of the rare mongoose lemurs, also from Madagascar and now in residence at the Trust, will follow the example of their "countrymen." Durrell also awaits the breeding of a recently arrived pair of Balinese mynahs.

The Trust's successes with the white eared pheasant have been backed up by four other "firsts" with rare birds. The thick-billed euphonia (a highly colored little bird from South America), the Mexican green jay and the gray and Gold Coast touracos have all been bred for the first time in captivity.

Inevitably, there have been disappointments. From a foray to Mexico in 1968, Durrell brought back three pairs of thick-billed parrots (see cover), found only in northern Mexico, Arizona and New Mexico. The parrots have hatched chicks, but none has lived for more than a few days. The main purpose of Durrell's Mexican expedition was to catch some of the rare volcano rabbits that live only in the vicinity of Popocatépetl and Ixtaccihuatl volcanoes just south of Mexico City. The volcano rabbits look like any normal baby rabbit, except for miniature ears. Durrell succeeded in bringing back seven to form a colony on Jersey. They settled in happily and quickly began to breed. Then, a couple of years after their arrival, all died suddenly of coccidiosis of the liver. The first success with breeding, however, has encouraged Durrell to negotiate with the Mexican authorities for more rabbits, which should arrive shortly in Jersey. He is also confident that repetition of the liver complaint can be avoided by regular medication.

But such setbacks cannot obscure the Trust's general breeding record. Last year, no less than 59 mammals and 148 birds were reared. And the Trust itself is attracting an ever-widening membership. As of May of this year, there were 5,650 members in 38 countries, including more than 1,000 in the United States and 500 in Canada. (An overseas membership costs nine dollars.) Apart from their subscriptions, many members have pitched in by donating new homes for the animals. The thick-billed parrots, for instance, are all housed in cages paid for by American and Canadian admirers. And virtually every animal, bird and reptile has been "adopted," either by an individual (many of them children) or by schools in the Channel Islands and Britain. The "parent" pays the annual food bill and, in return, gets regular reports on progress or the birth of any offspring. Each adoption is acknowledged by a small plaque outside the cage. "Adoption gives people a sense of involvement," says Durrell. "They come and see the animals, bring their friends and proudly say 'This is mine.' "

Their help will be even more vital in the future as the list of threatened species grows daily. Durrell admits that he would be only too ready to offer sanctuary to any endangered creature, but that obviously is beyond the means of the Trust. Moreover, he is determined to establish large, high-quality breeding colonies of a carefully selected cross section of wildlife, rather than indulge in a mad scramble to house everything. Other zoos must shoulder the burden as well.

But good intentions can hardly solve the wildlife crisis. And Gerald Durrell has no illusions. "I'd like nothing better than close down the zoo because it was no longer needed," he says. "My ambition really is to do myself out of my hobby—but unfortunately I see no chance of that."

A productive couple, this pair of snowy owls has hatched and reared ten chicks in eight years at zoo.

A high mountain stream rushes to join others,
mingling to produce a roaring wild river.
Near glaciers the abundance of stream life is
limited by low temperatures in all seasons.

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Text and photographs by Laurence Pringle

The wild river, ribbon of life

Some rivers in the United States still run free, though none is untouched by Man. Their own brand of energy is complex and beautiful

Rivers have quiet beginnings—the whisper of snowflakes on tree boughs, the murmur of raindrops on leaves, the drip of moisture onto forest floors, the trickle of tiny rivulets. With these sounds, a roaring wild river is born.

"River." The word is repeatedly thrust into our consciousness. We read of worsening pollution downstream; we see pictures of a river afire in Cleveland, of dead fish in the Mississippi, Hudson and Columbia. Rivers bear the brunt of our industrial society.

Remarkably, even in the United States, some rivers still flow clear and wild. They are not untouched; nowhere on Earth is there a river unmarked by Man's heavy hand. Nevertheless, these wild rivers are the best we have, and they *are* very fine. Unpolluted, undammed, rich with living organisms, they are priceless laboratories where ecologists can try to unravel a complex skein of aquatic life.

The wild rivers of the United States are national treasures. Some have been preserved in the National Wild and Scenic Rivers System, begun in 1968. Others are being considered for inclusion in this federal program, but some of them may not survive long enough to gain protection.

Some rivers arise from glaciers: The Columbia and many other rivers in Northwestern North America are fed in part by glacial streams. Such streams form from the meltwater at the foot of the glacier and from snow and ice that melt on the glacier's surface. Some of the water in a glacial stream may have fallen as snow hundreds of years ago. The discharge of glacial streams is markedly affected by daily and seasonal temperatures; the volume of water is highest in the afternoon and in the late summer and it is lowest late at night and in the winter.

Most rivers arise from a mingling of many small streams. Trace these streams backward and you will find even smaller streams, beyond which are little oozing seeps and springs fed by rain and melted snow that have soaked into the soil and then deeper down into porous subsoils and rocks. This groundwater flows and trickles beneath the surface, coming out at low places. The amount of groundwater beneath the land is enormous, thousands of times greater than that which we see flowing in rivers.

The origin of a river can affect the living things in it. Aquatic insects of a glacier-fed river, at least near the glacier, must adapt their lives to its daily and seasonal fluctuations in volume. Close to their sources, spring-fed rivers provide quite a different environment. The volume of flow is usually steady and the temperature varies remarkably little from season to season. Because of the uniform temperature of spring waters, they are sometimes homes for animals that cannot survive in nearby streams. One example is a species of minnow that lives only in Kendall Warm Springs, a tributary of the wild Upper Green River in Wyoming.

Geologists sometimes call rivers "young," "middle-aged" or "mature." One river may "age" rapidly because the land it flows over is easily eroded; another stays "youthful" because its channel is composed of more resistant rock. In the ordinary time sense, rivers are ancient. Rivers are not just as old as the hills; they are older. Through the ages they helped carry off generations of mountains.

In wild rivers, as in all other ecosystems, living and nonliving factors affect each other in complex ways. For example, the flow of a river drops markedly as soon as the trees in its valley leaf out in the spring; the trees send tons of water into the atmosphere through transpiration—water that otherwise might have seeped into the river. The opening of tree leaves along a river also lessens the amount of sunlight reaching the water. Evaporation is reduced and this helps maintain cool water temperatures. The periods of maximum light are spring and fall, and it is in these seasons, rather than full summer, that water plants receive most of the radiant energy they need for photosynthesis.

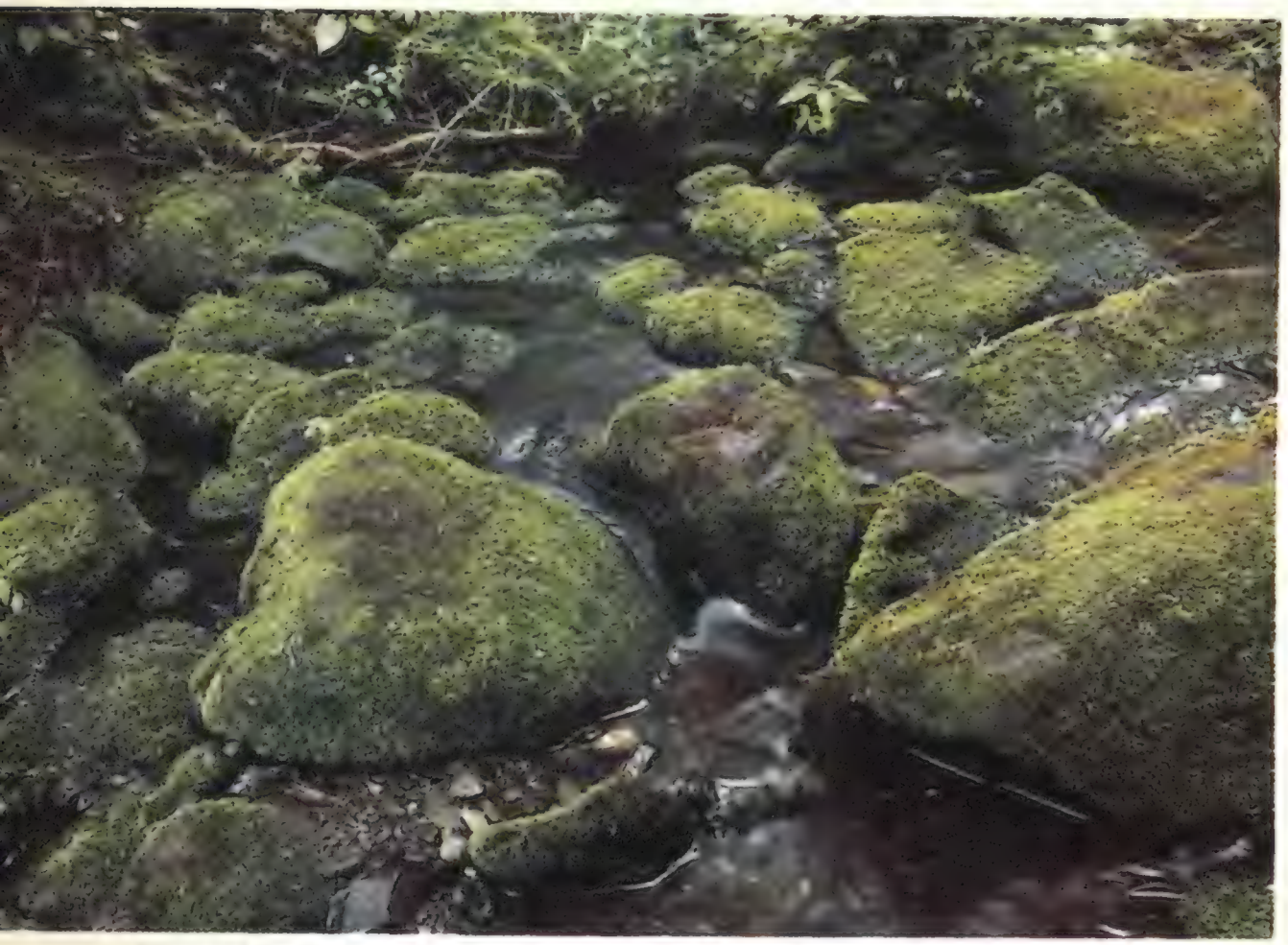
Because of friction most of the kinetic energy of a river's rushing water converts to heat energy at the boundary with the stream bed. This causes upward

Mr. Pringle was formerly an editor for Nature and Science *magazine. This is adapted from his book,* Wild River, *to be published this month by Lippincott.*

turbulence, which lifts and supports sediments. Turbulence is also caused by sudden changes in slope, or by a boulder or resistant ledge in the stream bed. The water rebounds off the bottom of the obstacle, producing a standing wave laced with air bubbles. All white-water, whether in waterfalls or riffles, is the result of air mixing with water.

A river's surface is marked with mysterious upwellings, puzzling swirls, unexplained eddies. What combination of rocks, flowing water and physical laws yields such designs? Why has the river laid down a sand and gravel bar in this place? How was the sediment sorted out so that it is coarse on one end and fine on the other? All along the river, mysteries unfold.

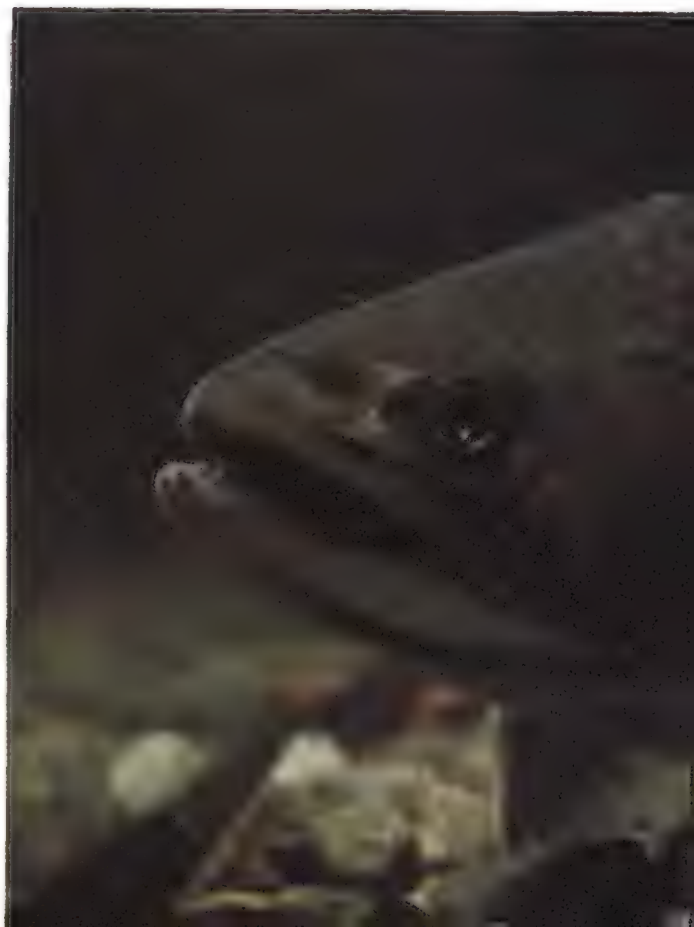
When a river's bed is made up of rocks of varying sizes, the water usually flows through a series of alter-



Flourishing in a tributary stream's shade, mosses cling to rocks with sturdy rhizoids.

Fallen leaves keep temperate-zone rivers "open," providing winter provender for a host of invertebrates.

An otter with frog: Formerly widespread, otters hold their own only where the rivers run free.



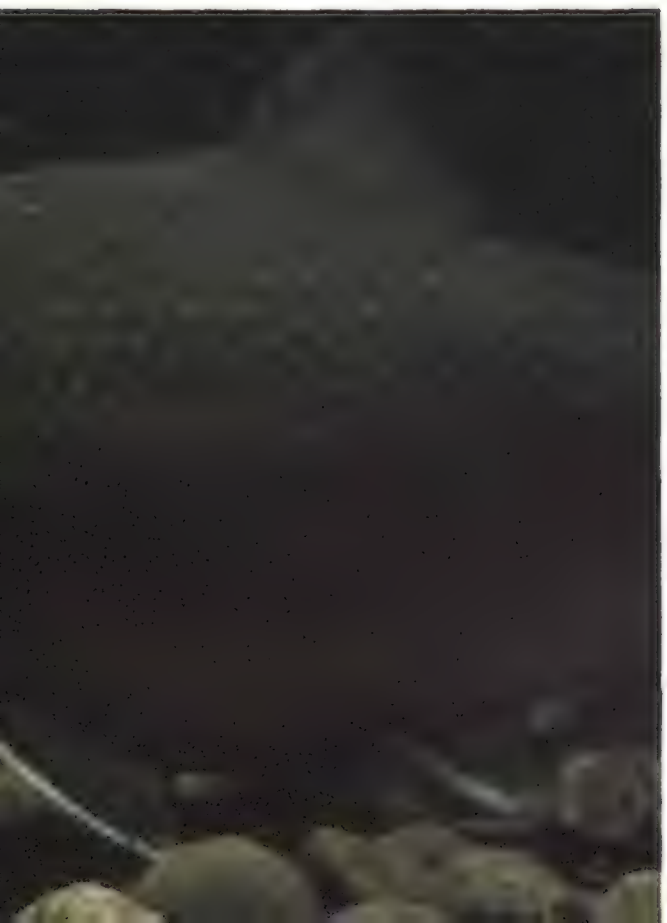
nating riffles and pools. Riffle-pool patterns do not form in streams with bottoms of uniform materials such as sand or silt. Most gravel-bed or boulder-bed rivers have riffles spaced more or less regularly every five to seven stream widths. No one knows why.

At places along the river you may see fluffs of what looks like detergent foam in little still-water places amid the riffles. Is this pollution in paradise? No. This foam appears in the wildest of streams; it is produced by a combination of chemicals from leaves and other organic matter, mixed and stirred by the tumbling water. It contains great numbers of spores from the fungi and bacteria that are so important in the decay of once-living material.

Tannins from leaves tint the water varying shades of amber—and in rivers where decay is slow or the load

Trout faces upstream to let water flow over gills, and feeds on invertebrates drifting by.

A crayfish exoskeleton will decompose into minerals and energy for new life in river.



The mayfly's delicate beauty belies its importance in a river's ecosystem's flow of energy.

of organic matter is great the water becomes quite dark. But a river's color involves more than its chemistry. Underwater algae and mosses, boulders, logs and silvery beds of sand also affect its color. Like a moving mirror, the river reflects the light of the sky and the colors of the hills and trees along its shores. In autumn, the river runs red and gold with the reflected fire of maples and aspens. When night falls, it becomes a silvery ribbon in the moonlight or, on dark nights, a black band of mystery.

Sit by a wild river for an hour and watch some of the workings of an ecosystem. Dragonflies patrol the shore, plucking mosquitoes and small moths from the air. A hatch of mayflies dimples the surface: Some are sucked under by trout; others are snatched up by swifts or swallows; still others flutter weakly to shore. A merganser swims by and suddenly dives for a minnow.

You are witnessing strands of the community's food webs, and the interdependence of its living organisms. But some of the most important organisms and processes go unnoticed or may even be hidden from view.

A wild river offers a wide variety of habitats for its most abundant plants, algae—riffles or pools, sun or shade, summer or winter, high or low rocks, among other choices. In the riffles, different kinds of algae grow best at different current speeds. In Michigan's Saline River, a biologist found one species of diatom that grew only where water flowed swiftly; it was not found in areas sheltered from the current.

Mosses are also part of a river's plant life, though they are not nearly so plentiful as algae. They thrive near cascades, waterfalls and rapids, where the water is rich in carbon dioxide as well as in oxygen. A thick mat of moss on a boulder may be a home for hundreds of minute animals—rotifers, copepods, scuds, water bears, insects, mites.

Scientists first assumed that algae, the major food-producing plants in most rivers, must also provide most of the primary energy of river ecosystems—the energy that flows through food webs to power the leaps of trout, the dives of otters. However, when they were finally able to measure the primary productivity of a few rivers, a surprising picture emerged. They discovered that these rivers often consumed more—sometimes much more—than the amount of energy produced by the algae. It seems that algae provide only a part—probably a very small one—of the energy in flowing water ecosystems.

Much of a river's living energy comes from golden aspen leaves, beech leaves, pine needles, fern fronds and thousands of other sources of organic matter in the river valley. Many insects and other invertebrates feed on this detritus, and especially on the bacteria and fungi that contribute to its breakdown. Some insects feed on water-soaked wood. Mussels and the larvae of blackflies are filter feeders; they sift fine particles of leaves and other material from the current. The leaves that enter a river in the autumn are a ready food source throughout the fall and winter.

The contribution of energy from the river valley to its waters is not merely in the form of dead leaves. Flowers and fruit of trees, and even the feces of land insects, add to a river's food energy. A river is a kind of year-round "sticky trap" for organic matter from the landscape. A study in Oregon showed that young coho salmon in wooded valleys received more than half of their energy from beyond the river water.

No one knows the full scope of the dependence of a river's aquatic life on the food energy of its valley. Undoubtedly, it varies from river to river and from place to place on the same river. Ecologists have noticed that prairie streams are relatively poor in aquatic life. Headwaters, however, are especially rich in food energy—these streams often flow through forests and are usually narrow, receiving more organic matter per unit area of stream bed than do bigger rivers.

Facts like these tend to slip from our consciousness when we visit a river in autumn. We hope to be entertained by a flight of geese or some other dramatic event or spectacular scene, but on some days nothing seems to be happening. No wildlife stirs along the river, the sky is overcast and the foliage past its peak. We head for home, somewhat disappointed, behind us a silent parade of dead leaves dots the dark surface, and then they sink to the bottom, one by one.

The spectacle of a river in autumn, reflecting the blue of the sky and the gold of aspen leaves, can divert our attention from vital processes of energy flow and nutrient cycling.

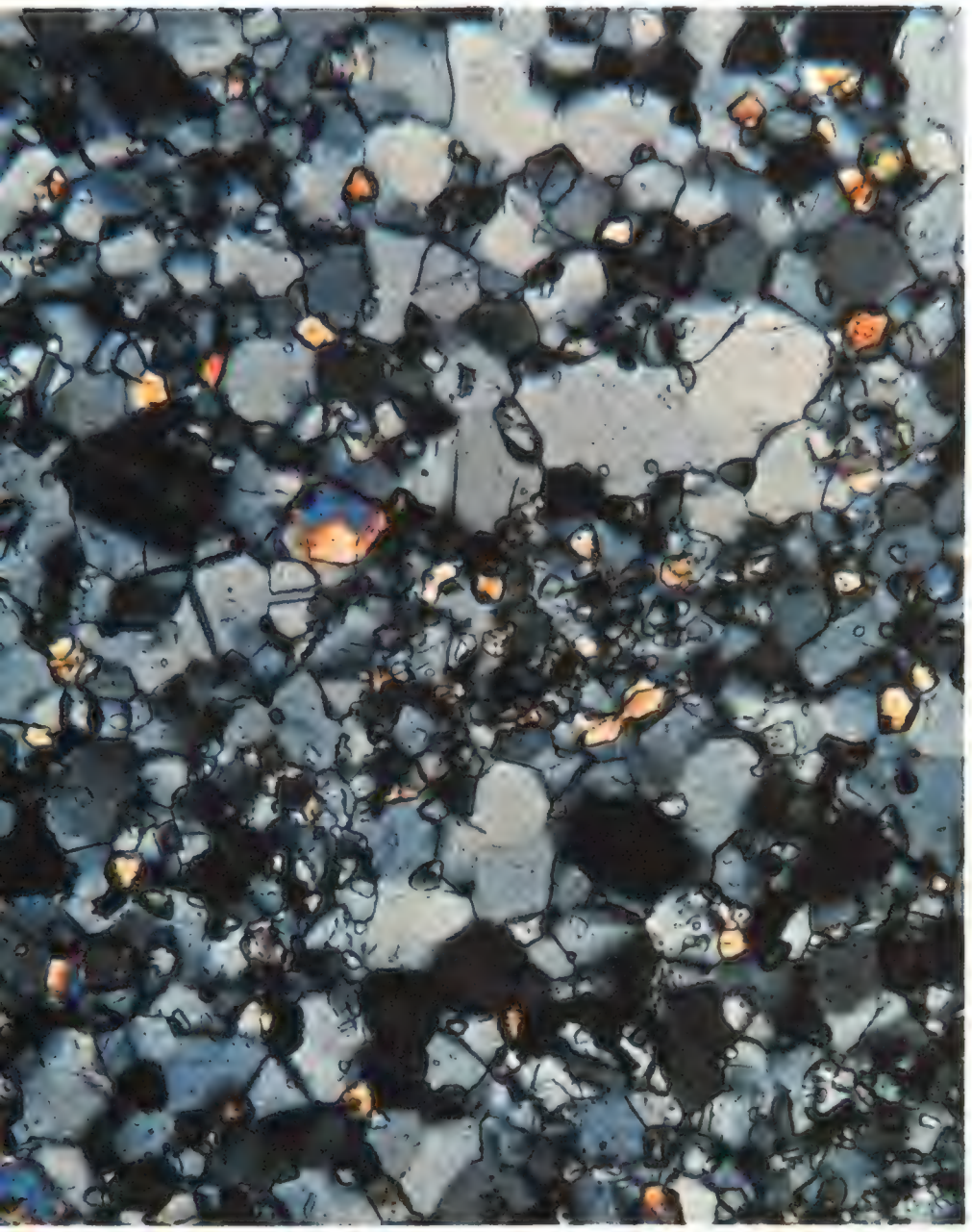
Collection of rock fragments from Apollo 12 sample (shown enlarged from their real size of about one-sixteenth inch each) shows deceptive diversity.

At right: one of the three principal rock types of the lunar crust—anorthosite—is seen through microscope under polarized light.

By John Wood

Ancient history now emerges from lunar rocks

By the sophisticated analysis of the Apollos' treasure—600 pounds of rock—the early violent life of the moon is being glimpsed



The average amount of sleep obtained by American citizens undoubtedly struck a historic low the night of July 20, 1969. That was the night when men first walked on the moon. Between 10:56 P.M. and 1:09 A.M. (Eastern Daylight Time) astronauts Neil Armstrong and Buzz Aldrin explored the lunar surface out to a distance of 65 yards from their spacecraft *Eagle,* collected samples of rock and soil, and set up a geophysical station. The eerie spectacle was televised and half the nation watched enthralled as the astronauts loped and bounded across a lunar landscape that was illuminated with theatrical brightness, but above which the heavens loomed jet black. The national euphoria persisted during the following three days as the Apollo astronauts successfully lifted off the moon, returned to Earth, splashed down into the Pacific Ocean and were quickly recovered.

A particularly exciting aspect of the conquest of the moon was the samples: The astronauts had brought back *pieces of the moon,* carefully packed in Teflon bags and hermetically sealed boxes. Now we would learn what a different planet is made of. The question was played up by the press and many citizens waited with some curiosity a week later to learn what was in the sample boxes.

When the nature of the lunar samples was determined, it turned out to be disappointing to the public: no novel substance unguessed by the most imaginative scientists, no new chemicals for which places would have to be created in the Periodic Table. Only a diversity of materials of a prosaic sort, minerals and rocks that were remarkably similar to those common on Earth (see photograph opposite).

Scientists who had tooled up to study the lunar samples were not disappointed, however. The lunar materials collected by Apollo 11 and later missions lived up to all their expectations. These rocks and soils, of unprecedented scientific value, contain a record of the birth and growing pains of a planet, a story that can never be read in Earth rocks because continuing geologic activity on our planet—crustal upheavals and weathering by wind and water—has destroyed its oldest rocks.

The history the moon rocks have to tell us is not written plainly or unambiguously, however. It is fragmented and cryptic. The pieces appear in the form of thousands of minor scientific observations, each of which illuminates some small aspect of what was going on in the young moon.

Fitting these pieces of the grand picture together has been likened to working a jigsaw puzzle or out-

Dr. Wood is a Principal Investigator in the Apollo lunar sample analysis program and is a staff scientist at Smithsonian Astrophysical Observatory.

guessing Hercule Poirot, and the analogies are fairly apt. But the puzzle-solving process takes time; it is only now that an understanding of the nature and history of the moon is beginning to emerge, more than three years after *Eagle* landed at Tranquillity Base.

Lunar samples can only be understood in the context of the geography of the moon. Most of the surface of the moon is rugged and light colored, but some low-lying areas are dark and relatively smooth. It looks for all the world like some dark liquid has ponded in these low places. Galileo first observed these geographic distinctions through a telescope, and suggested that the low dark surfaces might contain water; they are still called *maria*. The light, rugged terrain surrounding (and presumably also underlying) the maria are called *terrae:* continents or highlands.

Maria and terrae are not evenly distributed over the moon. The side of the moon that always faces Earth is about evenly divided between the two types of terrain, but the back of the moon consists almost entirely of terrae, or highlands. There is a pronounced concentration of mare surface in the northwest quadrant of the side of the moon we see.

The depressions on the moon that contain maria are of several types. Some are simply areas that are low for no obvious reason. Others, however, are giant basins gouged out of the lunar surface in ages past by the impact of asteroids or other planetesimals. These basins have all the earmarks of impact structures: a circular shape, an upthrust rim, and concentrically arranged deposits of material ejected from the crater, much like the famous Meteor Crater in Arizona.

The most conspicuous lunar example is the basin of Mare Imbrium, the great circular structure that dominates the northwest quadrant of the lunar near side. The cataclysmic impact that created Mare Imbrium constitutes a major landmark in the history of the moon: Lesser events on the moon are commonly reckoned as pre-Imbrian or post-Imbrian in age.

Deposits of debris thrown out of huge impact craters ought to be considered a third type of lunar terrain. Though light in color and often found high topographically, the material (called ejecta) that forms these deposits has something special about it: It once resided some miles deep in the moon, and may be different in character from terra material that has always been near the surface.

The Apollo and (unmanned) Russian Luna missions have sampled these three lunar terrains fairly systematically. An astonishing amount of lunar material has been returned by now—600 pounds: more than a quarter of a ton.

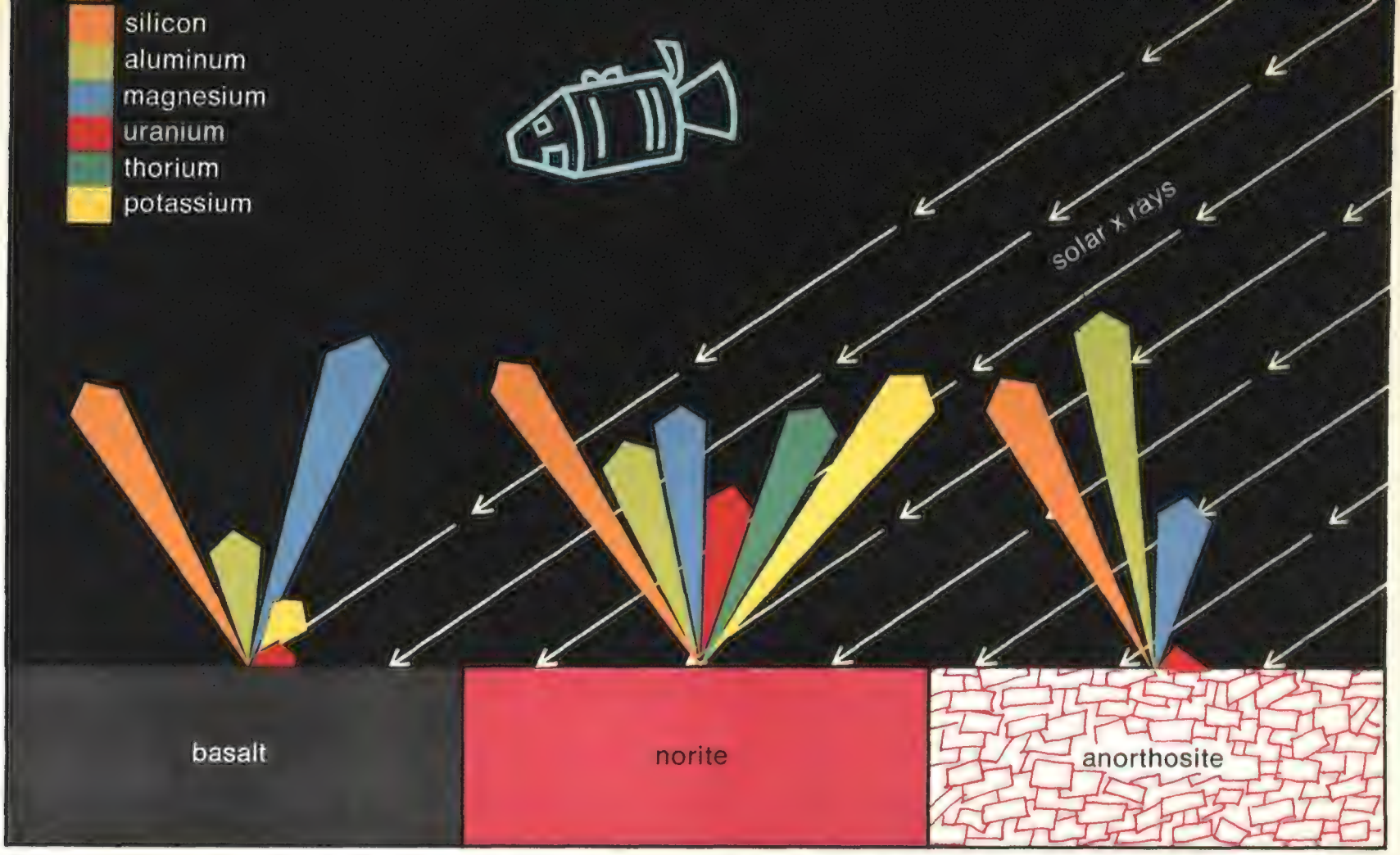
How do you study a sample of the moon? One obvious approach is to make a chemical analysis of the sample, or its component parts. A number of laboratories around the world do this.

Reading the "atomic clocks"

Another approach is to read the "atomic clocks" present in the samples. For example, one isotope of the element potassium is radioactive. This potassium isotope decays into an inert isotope of the gas argon *at a known rate*. So, by determining the ratio of parent potassium to daughter argon, it is possible to read the "age" of the sample. The same process occurs with several other elements, so one piece of lunar rock might have several "clocks" locked in it for us to read. But the "age" can have several meanings. It may refer to the time since a particular rock crystallized from a molten lava, or the time since it was last heated hot enough to cause its isotopes to rearrange themselves (but not hot enough to actually melt it).

My own research group at the Smithsonian Astrophysical Observatory looks at the samples from a geological point of view. We study the samples on a microscopic scale, determining which minerals are present and just what types of rock we are dealing with. The lunar rocks are similar to certain terrestrial rock types; from having studied these terrestrial analogues for many years, we know what geological processes are likely to have produced them.

Although a quarter of a ton of lunar samples has been collected at seven different sites by now, virtually all the fragments can be placed in one of three categories. The small number of rock types on the moon is interesting in itself. Continued geologic activity has the effect of producing more and more rock types. Samples taken at seven sites on the Earth, which has been geologically active to the present day, would include a plethora of rock types. The moon's paucity of rock types confirms our notion that the moon was



Gamma rays are emitted by radioactive elements uranium, thorium and potassium, in lunar soil. Solar X rays stimulate silicon, aluminum and magnesium, also in soil, to emit X rays. By detecting different wavelengths and abundances (as suggested by arrow length), command module determined rock types.

geologically active for only a relatively short time after it was formed. The fact that the moon was "alive" for such a short time, and that lunar rocks have survived unchanged from this early epoch, is what makes the lunar samples so interesting to earth scientists.

The most straightforward type of lunar rock is basalt, a volcanic rock (see page 42). Basalts are common on Earth. The Hawaiian Islands, for example, consist of lava flows that have cooled and hardened into basalt rock. The lunar basalts, which are dark in color, have been collected from mare surfaces. It is clear now that the dark liquids which ponded in the mare basins were vast floods of basaltic lava.

The "atomic clocks" of the basalt samples show that they are 3.2 to 4 billion years old: That is, they erupted onto the lunar surface, cooled and crystallized roughly a billion years after the moon formed. (Studies of meteorites, the oldest known form of planetary material, have shown that the solar system formed 4.6 billion years ago. It is generally believed that all the bodies in the solar system are of the same vintage.)

The second lunar rock type is termed norite because of its mineralogical similarities to terrestrial rocks of that name. The most striking property of lunar norites is their high content of the radioactive elements uranium, thorium and potassium. Lunar norite, like mare basalt, may have been a type of lava, or magma, that poured out on the surface of the moon. However, it is not possible to check for the telltale pattern of interlocking crystals that can usually be seen when volcanic rocks are examined under the microscope because almost all lunar norite samples are what geologists call breccias, which are welded together aggregations of rock and mineral fragments.

After the lunar norites were formed (by whatever means), something acted to grind them to powder, erasing whatever primary texture they may have had. Then heat and pressure fused the powdery rubble into solid rock again. Undoubtedly the grinding was the result of meteoroid bombardment. The great density of craters on the lunar surface shows that space must have been full of stray objects in early times, and these bombarded the moon (and Earth) mercilessly.

The Imbrium basin debris sampled by Apollo 14 consists almost entirely of noritic breccias. Both the crushed-up character of the rock and the fact that the aggregations have been fused together by heat can be attributed to the Imbrium impact itself. Such a colossally violent impact would heat its target as well as shatter it. When the blanket of debris from the Imbrium impact fell to the lunar surface, it was probably glowing red-hot.

Just as brecciation destroys the primary microscopic texture of a rock, it also obscures its age. Ages of the lunar norites are consistently about 3.9 billion years, but this almost certainly marks the time when the rocks were crushed and heated, not the earlier time when lunar norites were first generated. Apparently, the Imbrium planetesimals blasted into the lunar surface 3.9 billion years ago.

Geological events near Mare Imbrium: Soon after moon formed, surface layer melted to great depth (1). As it cooled (2), minerals crystallized, lightest one floated to surface to form solid anorthosite crust. Last of magma, now of norite composition, erupted through crust (3), flooding the surface.

The third type of rock abundant on the moon is anorthosite, a rock that consists largely of one mineral, plagioclase (see page 37). Lunar anorthosite was first seen in the form of light-colored fragments in the soil collected by Apollo 11 and it was suggested that these might have come from the light-colored lunar highlands that lay 30 miles south of Tranquillity Base. The Apollo 16 mission to the highlands vindicated this idea by bringing back samples that consisted largely of anorthosites.

Anorthosite is rare on Earth, occurring as great igneous bodies in a few scattered localities including the Adirondack Mountains. The process by which they are formed is not well understood. There are objections from the point of view of chemistry to having an anorthositic lava on the moon analogous to its basaltic and noritic lavas. A rock melt just would not have so much of some elements (calcium and aluminum) and so little of others (iron and magnesium).

The special thing about anorthosite is that it contains a lot of one particular mineral. If we are to understand the formation of anorthosite, we have to look for a natural process that acts to gather up crystals of a particular mineral and horde them in one place. There is such a process. When minerals begin to crystallize from a cooling rock melt, the crystals generally differ in specific gravity from the residual liquid surrounding them. If the crystals are denser than the liquid, they tend to sink in it; if lighter, they float up and accumulate at the top of the system. Plagioclase is a relatively light mineral and it is likely to have accumulated at the top of a pool of melted rock on the moon. When the liquid between plagioclase crystals had completely solidified, this cumulate layer would consist of the rock anorthosite.

The process is called gravitational crystal fractionation and it is not a hypothetical process—it actually works. The evidence can be seen in terrestrial rocks. Erosion has laid bare masses of igneous rock that cooled and solidified eons ago, and often these are found to have arranged themselves into horizontal layers in which one or another type of mineral has been concentrated: dense layers at the bottom, light ones at the top. In some of these cases anorthositic layers are present.

We are prevented from learning the age of lunar anorthosites from the samples examined to date by the same circumstance that hampers our study of norites: The anorthosites have also been brecciated and otherwise rearranged by the early meteoroid bombardment of the moon. But we know they are old. An anorthosite collected by Apollo 15 called the "genesis rock," shows an age of 4.1 billion years and it is clear that this refers only to the *last* of a series of brecciating events that affected a rock created earlier.

Basalt, norite and anorthosite: We know the dominant crustal rock types at seven points on the moon. But what about the vast areas between them? Instruments carried by the Apollo 15 and 16 Command and Service Modules (CSM) have answered this question, allowing us to generalize with confidence about the compositions of widespread areas on the moon.

Each Command and Service Module orbited the moon with one astronaut aboard, while the other two astronauts in the Lunar Module visited the lunar surface. During this time the CSM trained analytical instruments including an X-ray spectrometer and a gamma-ray spectrometer on the band of lunar surface it was passing over. These detected the characteristic elemental abundances of mare basalt, norite and an-

Long after norite solidified (4), huge meteoroid excavated Mare Imbrium basin 3.9 billion years ago. Basalt lava melted deep in moon (5) and erupted to surface, filling low areas 3.5 billion years ago. Impact at Copernicus (6) penetrated basalt one billion years ago and spread norite on surface.

orthosite in soils covering extensive areas on the lunar surface (see illustration page 39).

They showed that the lunar terrae, the highlands, are everywhere anorthositic in character, not just in the vicinity of the Apollo 16 site. The dark maria are composed of mare basalt, with one exception: In the vicinity of Mare Imbrium, the composition registered over mare terrain was noritic. We believe that the mare basalt in this area is underlain by norite, and planetesimal impacts that created craters such as Copernicus penetrated the basalt and ejected rays of radioactive, brecciated noritic debris on the lunar surface.

The moon appears to be wrapped in a thick crust of anorthosite (perhaps 30 miles thick, according to seismological measurements made by the Apollo geophysical stations), on which the maria form only minor blemishes. It is this light-colored anorthosite crust that makes the moon shine so brightly.

If the thick layer of anorthosite came into being by gravity fractionation, as I suggested earlier, then an enormous amount of melted rock must have been present in earlier times. In fact, the moon must have been covered by an enormous ocean of magma 100 miles or more deep.

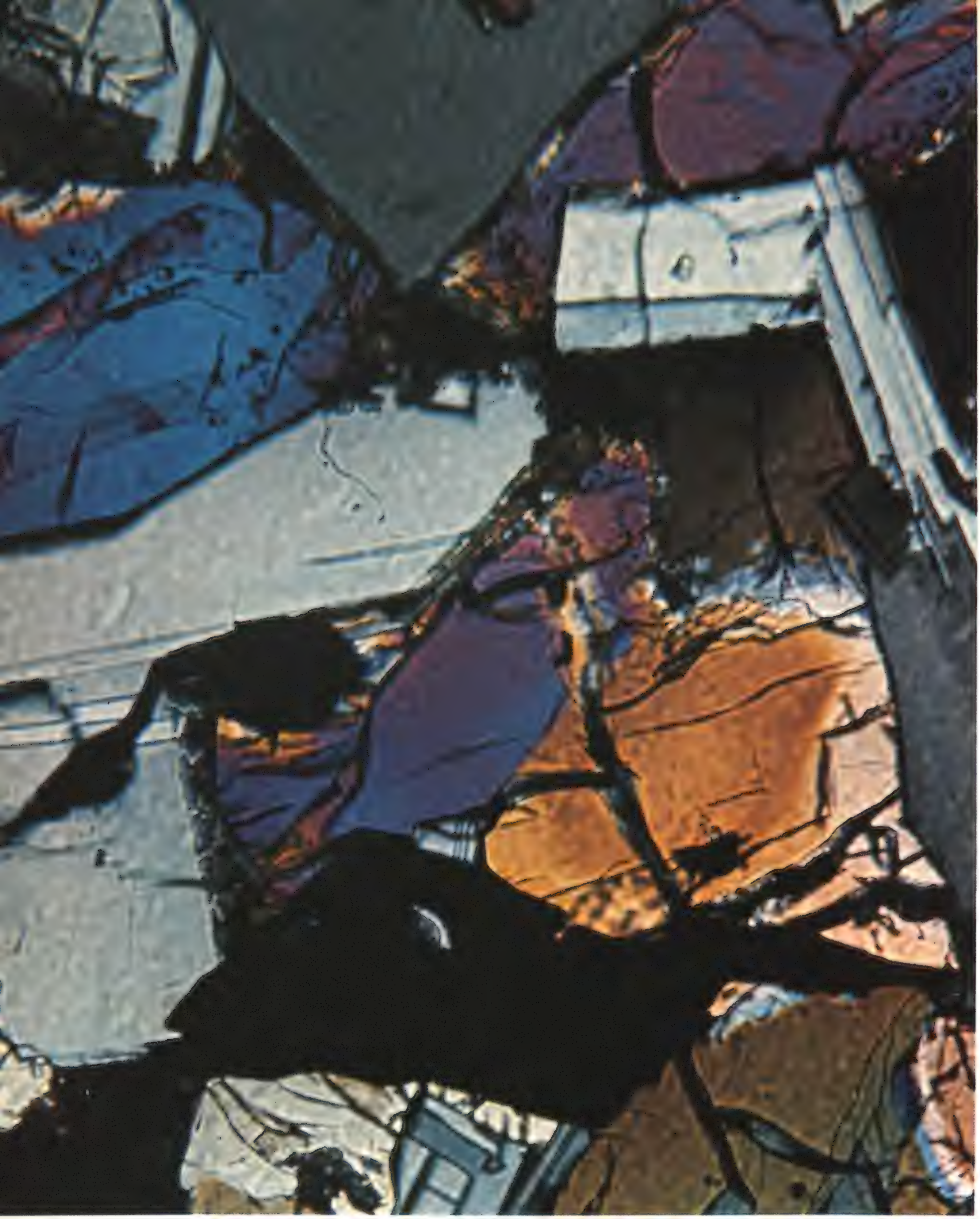
Where did the prodigious energy come from to melt that much rock? The moon and the planets, it is believed, came about when vast quantities of debris in space accumulated and the violence of the accretion process could possibly have furnished enough energy to melt the layers of the moon as they accumulated.

Prior to seeing the lunar samples, scientists generally believed that the process by which the planets formed was a relatively gentle, cool and unexciting one. The concept that a planet would be so drastically heated and differentiated in the very act of its birth is one of the lunar program's major contributions to our understanding of nature.

Starting with the ocean of liquid rock on the surface of the moon, we can now tentatively trace the evolution of the lunar crust in the vicinity of Mare Imbrium (see illustrations above). But this scheme would not apply elsewhere on the moon. The CSM gamma-ray spectrometer found high levels of radioactivity, signifying the presence of norite, only in the northwest quadrant of the lunar near side, the vicinity of the Mare Imbrium. The moon is asymmetric, not only geographically (in the distribution of maria) but chemically (the distribution of norite) .

Something must have happened to the moon differently on the Earth-facing side than on the far side. What this might have been is one of the several second-generation problems lunar investigators are now facing. Another concerns the duration of volcanic activity on the moon. The last of the Apollo missions, Apollo 17, will land in an area where a dark layer, perhaps volcanic ash, has apparently covered up the moon's old pockmarks. This suggests that it is a young deposit. If the layer turns out to be volcanic ash, it could mean that geological activity has continued until far more recently than we thought.

For now, however, from a relative handful of lunar material and some sophisticated observations, we can see a moon being born in violence and intense heat, cooling later to form its thick rocky crust. During the next billion years, this crust would be violated from below as molten lavas forced their way to the surface, and bludgeoned from above by a rain of planetary debris. Then, in some age yet to be determined, the moon died, geologically, and became a place of few significant events until men arrived.



Microscopic view of lunar basalt, one of three main lunar rock types, which rose through the moon's crust, filling in shallow basins on surface to form the dark-colored areas called maria.

Teach him to dial "O" and he'll always have a friend.

Of all the important things your child should learn, there's one he should learn right away.

That's how to dial "O" when he needs help in a hurry and doesn't know the number. Because the telephone operator is a friend who wants to help and, what's more important, *can* help in an emergency.

It's important. It may even be critical. Because a frightened, crying child's ability to dial "O" could save a life. Your child's life. Maybe yours.

Tell your child not to be afraid to call. After all, 100,000 times a day, the sick, the injured and the frightened dial "O" for help.

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Of course, the extra time and training that operators receive in order to handle emergency calls costs extra money. But it's worth it. Because you know there's always help on the other end of your telephone line if you dial "O."

AT&T and your local Bell Company.

By Warren Robbins

How to approach the traditional African sculpture

It is not just 'primitive' or 'exotic,' but a language in plastic form—and to see it one must master the vocabulary

Americans are discovering African art. It is not for lack of opportunity in the past: Splendid collections, both public and private, have existed in the United States for a long time. But, until recently, many museums presented their holdings as ethnographic displays, or even consigned them to storage shelves. Now they are exhibiting them as fine art. And in Washington, D.C., the eight-year-old Museum of African Art—the only one in the country devoted exclusively to the traditional arts of Africa—has mounted its most ambitious effort yet, a loan exhibition of over 400 items.

In the course of preparing the show, which runs through the end of 1972, the Museum discovered a remarkably large number of collectors of African art—probably as many as 300—in the metropolitan Washington area alone. All of this indicates a public appetite for this art which perhaps five years ago would have been inconceivable.

The forces behind this new interest are easy enough to discern: The struggle for racial equality in this country and the rapid emergence of so many new independent nations in Africa have both contributed to the sudden growth of curiosity about the long-neglected history and culture of the world's black peoples.

Although eager to look at African art, most museumgoers are not yet prepared to *see* it in more than a

Mr. Robbins, a former Foreign Service officer, is founder and director of the Museum of African Art at 316-318 A Street, N.E., in Washington.

NIGERIA A Janus-type headdress, reflected in a mirror (right), used by the Ekoi people to invoke ancestral approval for maintaining social order. It

Mr. and Mrs. William Howard Adams, Washington

is carved wood covered with antelope skin. The two faces symbolize the opposing forces of nature: male and female, life and death, light and dark.

Photographs by Lee Boltin

Robert and Nancy Nooter, Washington

IVORY COAST A Senufo "firespitter" mask for driving away sorcerers. Dancers could make the

ZAÏRE Above: This "messenger" mask is used in the initiation ritual of Biombo youths, and brings to their village news of their rebirth as adults. Below: A mother and child figure of the Kongo people, used to call upon the spirits of ancestors for the blessings of fertility and abundance.

Estate of Agnes E. Meyer

superficial sense. The usual Western view of tribal art is that it is "primitive," a collection of grotesque masks and distorted human figures, crudely executed, interesting primarily as ethnographic specimens and hardly to be mentioned in the same breath with so-called "civilized" art.

These preconceptions are deeply rooted in another set of assumptions about the role of art in society. Ever since the Renaissance, art has been given an increasingly specialized place in Western life. Puritanism, with its gospel of work, pushed art to the periphery of public concern. It came to be narrowly defined as something created by a small group of special people called "artists" to be appreciated and responded to by an only slightly larger group of people called, perhaps, "art lovers." Furthermore, we have clung to the notion that art must be "pure"—that is, irrelevant. Only in the last decade of explosive pop culture has the public begun to move toward the idea that art can vitally enrich our lives, and that it is a legitimate area of interest for all people and not just for a gifted few.

We can begin to understand African sculpture, then, only by setting aside the Western standards we automatically apply to works of art. We must give up the idea that the integrity of a work of art is somehow diminished if it serves a social function. Today we are fortunate in having at our disposal modern tools for evaluating the products of hitherto alien cultures. From the anthropologist, for example, we have the concept of cultural relativism. Modern anthropology

Robert and Nancy Nooter; photograph by Delmar Lipp

mask appear to be spitting fire by blowing resin-soaked grass over glowing coals in its mouth.

holds that a culture must be evaluated according to its effectiveness within its own environmental context. The language, social customs, religious beliefs and artifacts should not be judged against European or American counterparts, but viewed instead as elements of a total system with a validity of its own.

Properly understood, African art is a language in plastic form. Just as no serious student of French culture would attempt to penetrate its complexities without first knowing the French language, so anyone wishing to explore African culture must familiarize himself with the vocabulary of African sculpture.

The first task is to distinguish among the various kinds. There are four principal categories of African art: that which is referred to as "traditional"; tribal artifacts and crafts; contemporary art of a serious nature, which usually blends tribal motifs with modern Western styles; and, finally, "tourist" or "airport" art, which may bear some resemblance to traditional forms but is made specifically for export purposes.

Traditional art is primarily sculpture, created for religious or ceremonial functions and carved in strict accordance with conventions handed down from generation to generation. Most traditional African sculpture is made from wood, and few existing pieces are more than 100 years old. The ravages of termites (white ants) and sub-Saharan climate, as well as the common practice of destroying or discarding sculpture once its efficacy in tribal life has waned, account for the scarcity of older works. The exception is bronze

Mr. and Mrs. David Lloyd Kreeger, Washington

GHANA Portrait heads in terra-cotta were displayed at the funerals of Ashanti royalty and later placed on the graves of the deceased. The round face is characteristic of Ashanti art.

and gold objects, along with some works in terra-cotta, soapstone and other hard materials. From these more durable sculptures scholars have now begun to reconstruct the evolution of traditional art in certain areas of sub-Sahara Africa.

The great bulk of sculpture comes from the settled communities of farmers and townspeople in West and Central Africa. Some of the most outstanding art has come from the Bambara and Dogon peoples of Mali, the Baga of Guinea, the Senufo and Baule of the Ivory Coast and the Akan peoples, including the Ashanti of Ghana. In Nigeria the ancient Nok culture, the old kingdoms of Ife and Benin and the present-day Yoruba and Ibo peoples are noted for their vigorous and prolific artistic production. Other important groups include the Kota and Fang of Gabon, the Teke in Congo, the Kuba, Pende and Luba peoples of what is now called Zaïre, formerly Congo (Kinshasa). From all these peoples it is possible to distinguish more than 200 individual styles of art.

Westerners find it difficult to accept the extent to which the use of sculpture pervades African community life. We tend to give works of art only a passive

Robert and Nancy Nooter

UPPER VOLTA Among the various groups of Bobo peoples, the Fing are noted for this type of helmet mask. It represents the village's guardian spirit and is danced in agricultural ceremonies.

role in our own culture, where they are used either to decorate a home or to hang impersonally in a museum to be looked at and studied. But in a traditional African society, where there is no written language, sculpture is a principal vehicle for transmitting its philosophy, literature and moral and legal codes. The plastic forms of African art are the visible symbols in which the artist embodies his community's system of knowledge and belief.

For this reason, traditional sculpture must be understood as a conceptual rather than a representational art. Tyrannized as we have been by naturalism for the past 2,000 years, we are disturbed by the abstract nature of African art. We look skeptically at the "distortions" of African sculpture—its seeming disregard for the proper proportions of the human body, its simplified forms, its lack of realistic detail—without realizing that these are not the result of ineptitude but of the artist's concentration on the ideas his work is to communicate. For example, in nearly all the equestrian figures of kings, chiefs or important ancestors, the horse is dwarfed by his rider—not because African horses are unusually small but because the man's size compared to that of his mount signifies his dominant status in the community.

Each tribal style has its own system of visual emphasis. Often the head will be enlarged beyond normal proportions because it is regarded as the dwelling place of the "life force." In other cases breasts or genitals are emphasized as symbols of progenitive power, the navel because it embodies the all-important principle of continuity in life, and animal horns or tusks because they symbolize virility.

The purpose is to convey ideas

African artists do not "see" human beings and animals the way they carve them, any more than did Picasso and Braque. But since their art aims to convey ideas rather than to depict nature, it is logical that salient features will be emphasized and carved with special care. The principles of abstraction utilized by African carvers are as advanced and complex as those of modern Western artists. For example, Picasso's much-favored device of showing a head in full-face and profile at the same time is used with equal skill in the reliquary figures of the Kota of Gabon (from whose work Picasso may have derived the idea). African abstractions, however, belong to a plastic vocabulary which is familiar to all members of the community, while the language of modern Western abstraction is known principally to art scholars and the cognoscenti.

We must continually remind ourselves that the visual symbols of African sculpture are only parts of its total meaning. Masks, figures and other objects were not produced as "art for art's sake" or even simply as works of art with a message. In rituals or ceremonies most carvings become actual repositories for spirits. Thus ancestor figures, one of the most common African art forms, provide dwelling places for the spirits of deceased ancestors whose wisdom and authority may be called upon to aid the community of the living. Among several peoples in Liberia, Sierra Leone and the Ivory Coast, a men's society called Poro—which bears some resemblance to a Western fraternal order—uses masks embodying ancestral authority to maintain social order. Much as the white wig of a British justice transforms him into the living representative of the law, masks give the full weight of ancestral power to the elders of the Poro society as they hear criminal cases, settle land disputes, instruct young people or simply appear to instill a fear of authority.

Female ancestor figures are often associated with fertility. Barren women of the Senufo people of the Ivory Coast offer food and prayers before the figure of

a mother and child in the hope of being granted offspring, just as childless women in the West invoke the help of Christian saints.

Sculpture is also used to evoke or placate the natural forces which shape the environment and influence communal life. At the time of the winter solstice, dancers of the Nafana people of the Ivory Coast, wearing large carved and painted masks, visit each house, absorbing evil and disharmony and enabling the community to begin the new year cleansed and purified. Figures or masks are also employed by healers to cure illness and ward off disease; in the hands of a skilled practitioner these symbolic objects constitute an effective element of psychosomatic medicine.

Animal masks and carvings, especially composite pieces incorporating features of several species, are used by many African peoples. The animals' essential qualities—speed, endurance, cunning, strength—are "captured" in the sculpture and ceremonially utilized. Composite pieces are thought to be especially efficacious, since they gather together the characteristics of the several animals whose spirits inhabit them.

Because the symbolism of African sculpture was understood and accepted by all the people who made and used it, as a reflection of commonly held beliefs, it served as a powerful force for social cohesion. Fully integrated with what we would call the performing arts—music, dance, mime and drama—traditional art had a central place in the vital ceremonies that bound people together as a social unit.

Concentrating the "life force"

While individual tribal styles vary greatly, certain qualities are common to almost all African art. Perhaps the most notable is its dynamism or "captive energy," which gives an effect of monumentality to even the smallest pieces. This quality is an expression of the African belief in a "life force" which pervades all things, animate and inanimate. The famed 19th-century priest-ethnographer Placide Tempels noted that at the core of all African philosophy is a theory of immanent energy: the belief that all existence is dynamic, and that the essential task of life is to attract to oneself and to the community the greatest possible concentration of this life force. This conviction may help to explain the uncanny affinity of the African carver for his material, which enables him to incorporate the grain of a piece of wood into his design so naturally that the wood seems more alive than it was as part of a growing tree.

From modern art history we learn that African sculpture had a profound influence on some of the giants of 20th-century art, including—in addition to Picasso—Matisse, Modigliani and the German Expres-

Mr. and Mrs. David Lloyd Kreeger

GABON Above: A Kota reliquary figure of wood covered with strips of metal. It depicts the face of a woman with stylized eyes, nose and ears; the body is reduced to a diamond-shaped form. Highly prized in the West, such abstract figures strongly influenced the early Cubist artists. Below: The white face of this mask from the Ogowe River region symbolizes the concept of a spirit.

Mr. and Mrs. David Lloyd Kreeger

sionists. In the quantities of African sculpture brought to Europe in the 19th and early 20th centuries as ethnographic material, these artists were able to discern qualities which would become central to their own artistic formulations. This influence has in recent years been used to "legitimize" African tribal sculpture. Rather, it should be viewed as the response of a few unfettered individuals to what was already a major creative achievement.

While artists intuitively recognized the skill and esthetic awareness embodied in African art, scholars are only now beginning to appreciate the degree to which it is highly evolved and sophisticated. The complex surface ornament present on so much sculpture, for instance, is hardly a case of *horror vacui,* but rather a device for giving continuity to the basic lines of a piece. It is the plastic counterpart of the polyrhythmic music and dance of Africa, which are difficult for most Westerners to follow.

Sculpture is so closely woven into the fabric of life that among a few peoples all of the adult males make carvings. Most groups, however, recognize master artists and hold them in great esteem. Bambara blacksmiths, for example, are highly respected for the spiritual power thought to derive from their skill in working iron and wood.

By any standard, the African carver is a skilled and disciplined artist who knows exactly what he is doing and why he is doing it. His special genius is the ability to work within a prescribed tradition and yet imbue his work with individual refinement and imagination.

While most extant African sculpture is relatively recent, there is evidence to suggest that it has followed as long and complex an evolution as Western art. In a few areas of modern Africa a reconstruction of African art history has begun. Nigeria has thus far offered the richest field for investigation. Recent archaeological work there has yielded artistic discoveries of immense importance, from the expressive terra-cotta heads of the Nok culture (400 B.C. to A.D. 200) uncovered in 1943 to the naturalistic heads of the Ife kingdom of the 12th and 13th centuries and the extraordinary cast-bronze court art of the Benin kingdom (13th to 19th centuries).

Archaeologists have also established that some of the earliest paintings known to man—the extensive

SIERRA LEONE These masks are worn by women of the Mende people in initiation ceremonies. The rings around the neck may represent folds of fat, an attribute of feminine beauty among the Mende.

animal and figure paintings discovered by Henri Lhote in the Sahara—as well as the earliest extant pottery are African. Art works and historical traditions bear witness to the status of ancient African kingdoms, among them the Jokwe kingdom of present-day Angola and Zaïre, which numbered more than a million hunters and farmers and remained powerful until the 19th century; the Kuba kingdom, also of Zaïre, whose monarchs were famous art patrons; and the Krinjabo kingdom of the Ivory Coast, whose terracotta heads and figures were used to mark the graves of deceased rulers.

As more scholars are attracted to African studies, many of the myths and misconceptions that have inhibited our understanding are being discarded. Of these, one of the most cherished—of African art as "primitive"—is on the way to extinction. Derived from the Latin *primus* (meaning simply first or original), the word has come to denote that which is crude or unsophisticated or clumsy. No term could be less appropriate to the varied and complex forms of African art—which can, indeed, be more correctly described as "classical" since it proceeds from rigorous and evolved traditions of considerable antiquity.

As our opportunities to see African sculpture increase, we are learning to perceive in it an insistent creative force, the power to evoke emotion, disciplined stylistic traditions, a remarkable degree of artistic technique and a subtle use of symbolic abstraction to convey meaning. In its rich variety, traditional art reflects Africa's immense contribution to the cultural heritage of mankind.

Mr. and Mrs. Albert Votaw, Mr. and Mrs. MacKenzie Gordon, Gary Mansavage, Washington

Fishermen ply the soon-to-be-closed Oosterschelde at dawn, in pursuit of the finest mussels in all Europe. The dam will end this "most civilized trade."

Photographs by Farrell Grehan

By Donald Gould

Holes are showing in planned Dutch defense against sea

All but the final estuary has been dammed in Holland's Delta Project but some ecologists and fishermen call for a halt

On the night of February 1, 1953, a wall of seawater as high as a house swept across great tracts of farmland in southwest Holland during a severe storm, killing 1,800 people and uncounted cattle, toppling homes and barns and poisoning the land with salt so that much of it was barren for a year or more.

A good part of the flooded country was below sea level and was only kept dry by the dikes which hedge Holland's shoreline. Everybody knew that the great, wide banks of dirt and stone were not invulnerable and that once every few hundred years a freak sea might breach them. Every so often smaller floods occur, and, in wartime, Dutchmen have deliberately flooded their lands. But no comparable natural disaster had struck Holland in over 300 years and the instant reaction of the Dutch people, and of their government, was a determination that nothing like it should ever happen again.

Because of her constant struggle against the marauding sea, Holland breeds the world's most skilled and enterprising water engineers. Five years after the flood, the Dutch Parliament passed the Delta Act, which will shorten the country's coastline by more than 400 miles, may cost up to $1 billion, and will remove forever the risk of flooding of the southwest lowlands by the sea (see map on page 54).

When first announced the scheme was universally acclaimed. Now, with the work three-fourths completed, a growing number of vocal Dutch citizens are accusing their government of blindly and recklessly destroying a significant part of the country's wildlife, social patterns and natural beauty. Vigorous attempts are being made to persuade the authorities to abandon the final and most damaging stage of the engineering works, and to find some other way of protecting the people of the delta from another inundation. But the government shows no sign of changing its mind.

The completed dam across the Haringvliet entrance incorporates a bank of sluice gates to let the Rhine water out into the sea. But the Brouwershavense Gat and the Grevelingen dam are solid, so that the water behind both is still. So far the Oosterschelde is still open—work on the solid dam that will close it off has only just begun, and won't be finished until 1978—and this is the area of water which most of the present fuss is all about.

The Veersche Gat has been a small closed lake since 1961. Frank Spaargaren, Delta Project enthusiast and a senior engineer in charge of the Oosterschelde site, claims that the water now holds more fish than before, that there are new plants growing on its shores and that the rain has made a layer of sweet, fresh water on the top of the brackish lake. The whole exercise, he claims, apart from protecting the people who live along its shores from the sea, has proved to be both a boon and a blessing to men. Critics feel they have lost a little slice of nature and been handed a municipal boating pond instead.

The broad Westerschelde is not to be closed. Ships use it. It is Antwerp's outlet to the sea. Damming the Westerschelde would cost a lot of people money, and, say the men from the Rijkswaterstaat, the government department in charge of the Delta Project, it might be the best possible way of starting a dispute with Belgium. And yet the worst damage done on that dreadful night in 1953 was to the farmland and villages on the north bank of the Westerschelde, for it was there that the major breaches in the dikes occurred.

There have been plans for feeding Rhine water into the Oosterschelde, once it has been closed. The great difficulty likely to arise is that the "fresh" Rhine water is, in fact, anything *but* fresh. Those who campaign against the closure of the creeks are appalled at the prospect of seeing them turned into gigantic septic tanks for Frankfurt, Düsseldorf and Cologne.

Spaargaren believes the answer lies in cleaning up the Rhine, and thinks his government might even pay Germany and France to help them install the machinery needed to purify their industrial excretions.

In opposition, there is a Delta Study Group led by a retired engineer, Jan Loeff, who lives in the exquisite

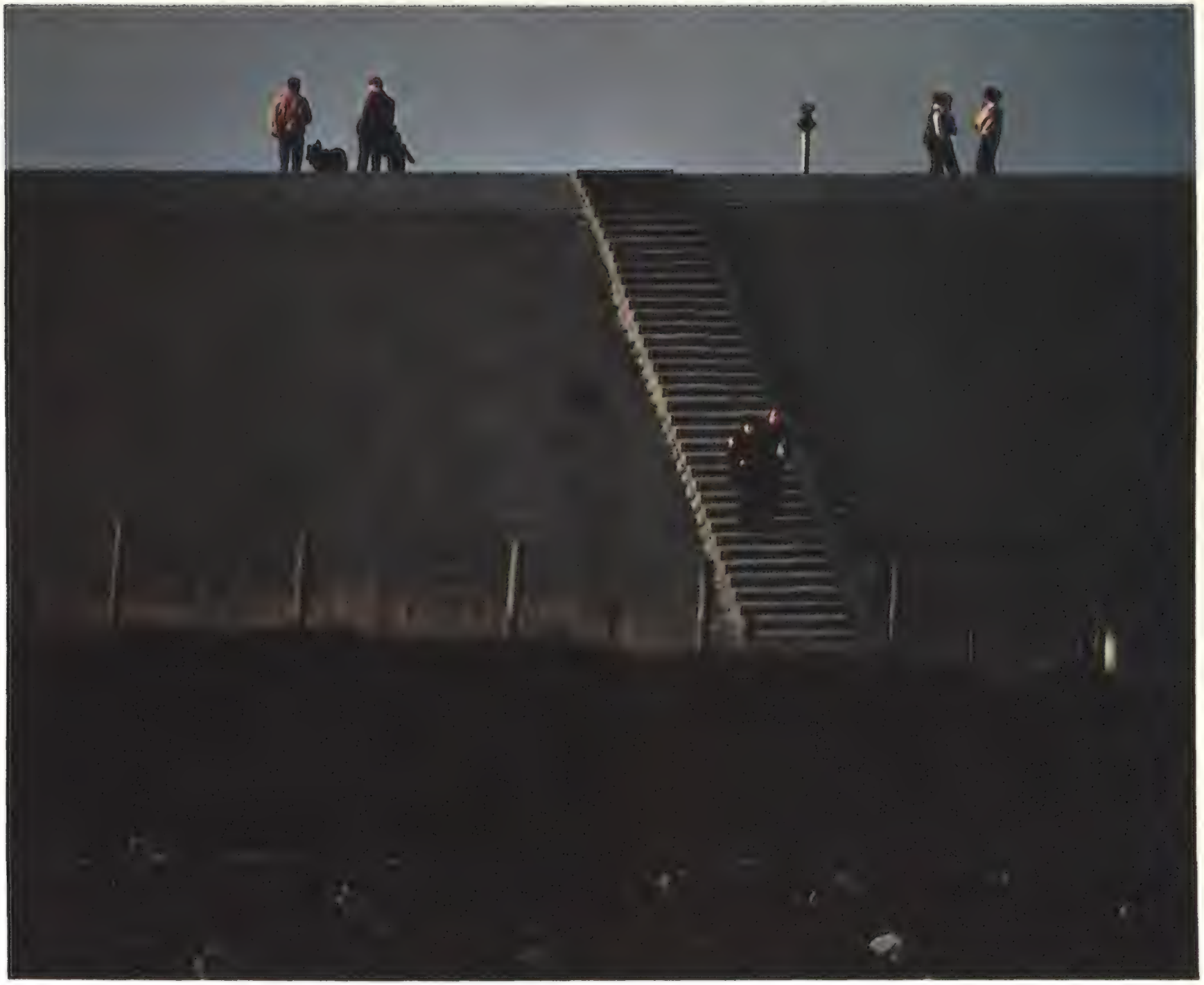
Dr. Gould has written for SMITHSONIAN *about the cleanup of London and the efforts of a three-woman antipollution league in Britain's Midlands.*

Holland's ambitious scheme to protect southwestern lowlanders from flood is largely complete. The dam on the Oosterschelde is under construction—and attack.

village of Veere on the shores of the Veersche Gat. Loeff, a formidable fighter, pours scorn on the plans for freshening up the lakes. He explains that the Delta Project, as well as keeping back the sea, was supposed to provide ample fresh water for the brisk expansion of market gardening and agriculture. As a hardheaded realist of 77, he is convinced that it will take decades to control the Rhine pollution, and that, while it remains polluted, all the new lakes will be useless, either for fishing, agriculture or pleasure. They will stink, he says. They will be dead.

And in any case, Loeff claims, recent experience shows that there simply isn't sufficient water coming down the Rhine to do the job the men of the Rijkswaterstaat want of it. His mistrust of the promise for fresh water is shared by Dr. K.F. Vaas, the director of the Delta Hydrographic Institute, which is a research laboratory established by Holland's Royal Academy to undertake a continuing study of the impact of the new lakes on the district's plant and animal life. Dr. Vaas points out that the Rhine water carries not only an ugly load of chemicals like heavy metals and pesticides, but also a rich concentration of nutrients, which encourage the growth of algae and hasten the process of eutrophication.

But even if a sudden and belated concern for the balance of life had not become so fashionable among the illuminati of the richer nations, the ordinary residents of the southwest lowlands can now plainly see for themselves that interfering with nature is a perilous exercise. The Grevelingen, cut off from the sea, no longer has a tide, and so, of course, all the creatures



Pedestrians stroll the dam that changed the Veersche Gat from an opening to the unpredictable North Sea into a closed, now brackish lake.

that used to inhabit its shores because they thrive on the regular rise and fall of water have disappeared.

"The pattern of life," Dr. Vaas says, "is a good deal poorer than it used to be."

It would be depressing enough for the lowlanders if the closing of the Oosterschelde were to be simply a repetition of the Grevelingen story. But the Oosterschelde has very special virtues, and its ruination would be an even graver loss.

There is a large tidal movement up the creek so that the whole 25 miles of its length is flushed out twice a day. The water is clean and full of oxygen, and the natives claim that the soil of the creek is most wonderfully rich. Whether this be so or not, the Oosterschelde is famous for mussels, oysters and lobsters. The export of these delicacies earns the district more than $30 million a year. French and Belgian connoisseurs of shellfish demand a genuine Oosterschelde product. So great is the demand for the creatures nurtured in this particular water that the Oosterschelde mussel fishermen regularly journey north to the Frisian coast, or to Denmark or to Germany to catch mussels and bring them back to the Oosterschelde beds, where they lie for a while before being harvested and sold. The same thing happens with oysters and lobsters.

There is a widespread and harmless belief that the mussels acquire some unique quality during their brief stay because of the purity and brightness of the water, but the sad secret is that the Oosterschelde fishermen bring these creatures to their home waters simply so they can then export them as genuine Oosterschelde graduates.

Part of the Haringvliet dam, a giant sluiceway soars overhead, designed to let the Rhine's water reach the sea. Below, water engineers assess currents in scale model of the Oosterschelde dam.

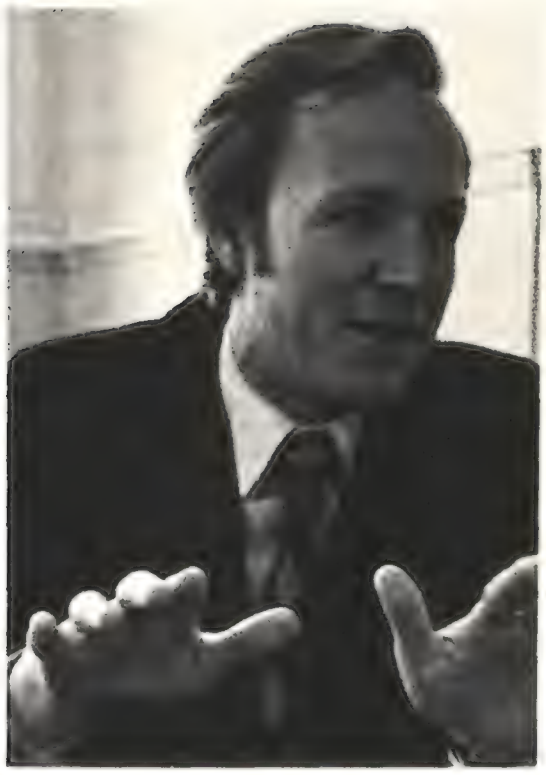
Hydrologist Vaas: new knowledge, portents of algae blooms and a call for a moratorium.

It does no harm. And apart from the mild deception of the label, the Oosterschelde does serve a genuine commercial function as a warehouse for these living delicacies, and is a highly convenient wholesale distribution point, serving fishmongers and chefs of gustatory Gaul.

Closure of the Oosterschelde would put an end to this most civilized trade. Hundreds of fishermen would find their livelihood destroyed. Some will be offered a patch of water to farm in the Waddenzee to the north, and the government proposes to set the rest up as chicken farmers or mushroom cultivators, which seems a poor exchange for a life on a well-found boat, devoted to the leisurely gathering of gentle shellfish.

Furthermore the Oosterschelde is a nursery for fish that live in the southern part of the North Sea. Flat fish move into the creek shortly after hatching and grow there for three or four years before moving back into the deep waters. If the Schelde River is cut off, then Belgian and East Anglian and perhaps Norwegian and German deep-sea fishermen may find that they, like the mussel brokers of the Oosterschelde, have lost a living. Dr. Vaas admits that the important nursery function of the Oosterschelde was not appreciated when the Delta Project was approved. He suggests that the loss of North Sea fish might be small, because there are other nursery grounds. But Boelmans Kranenburg, secretary general of the Dutch fishing industry's trade association, believes that if the Oosterschelde nursery goes, the southern part of the North Sea will become useless for commercial fishing.

The surprising thing is that no neighboring govern-



Politician Terlouw: Rational arguments don't exist in politics.

Retired engineer Loeff: Just build up the Oosterschelde's old dikes.

Dam builder Spaargaren: The dams have been a blessing to mankind.

ment has yet raised a whimper about this threat to their fishing grounds. Kranenburg thinks this is probably because they just don't know what is going on. "After all, *our* government isn't going to send them a picture postcard telling them all about it."

Plainly there are powerful arguments for keeping the Oosterschelde open. What is the case for closure? Safety. Once the last delta inlet has been closed, the danger of flooding will have been contained forever.

Also the influential technocrats of the Rijkswaterstaat are naturally biased in favor of their own original solution. Some of them have spent half a professional lifetime on the job. They have invented a whole series of novel means for doing something that has never been done before.

The Oosterschelde opening is five miles wide, which is too great a stretch of water to bridge with a single continuous cable system, and so, as a first stage, which is now completed, the outlet has been divided up by building three artificial islands along the line planned for the dam.

In some places the outlet is scored by deep channels, while in other spots there are sandbanks bringing the seabed very near the surface of the water. Luckily for the engineers there are three shallows almost evenly across the estuary mouth, so that is where the islands were made, simply by pumping sand on to the chosen spots and then protecting the banks of the soft, giant sand castles with bricks and rocks, covering the middle with a little clay, and sowing grass to keep the whole thing firm.

They are quite substantial additions to Dutch territory, being half a mile to a mile long and perhaps about a third as wide. Each has its own small harbor and quay, ready for the heavy traffic of men and materials and machines which will grow as the work on the big dam proceeds.

It will take another six years to finish the job. The second and longest stage began this spring. This is the task of laying mats of willow saplings (see pages 60-61) on the seabed in the gaps between the islands to form a firm and unshifting base for the pile of concrete blocks which will make the body of the dam. All through the summer, trucks brought millions of three-year-old willow saplings, cut from the banks of the Maas River, and unloaded them on the south shore of the Oosterschelde. There, a score or so of craftsmen wove the sweet-scented wood into mats.

The brushwood mattresses are huge—some 50 feet wide and almost 200 feet long. As each mat is finished (they make three a week) it is towed out to its final resting place and then slowly sunk. After the mattresses have been laid, gravel and then stones are dumped upon them until the base of the dam is some 26 feet high. Then comes the final stage—the dumping of the massive concrete blocks from the gondolas of the cable system, and this is a rapid job. They will reach this point, if all goes well, some time in 1977. Very shortly afterward the pile of giant building blocks will break the surface of the water and the Oosterschelde will be imprisoned and walled off from the sea which has fed it and kept it moving and alive since long before man arrived around its shores.

When the string of dams is complete, a road will be

Major Dutch bulwark against sea

built along the coastline and across them which, say the authorities, will open up the southwest lowlands so that the citizens of the industrial north can more easily bring their motorcars and families to the new pleasure grounds.

In the face of all this, does it really make sense to propose that the work on the Oosterschelde dam should stop, just for the sake of saving a few fish, a few birds, a picturesque but commercially inefficient way of life and a famous source of tasty mussels?

Jan Loeff and his allies are certain that the answer is "yes." They believe that the safety of the lowlanders living around the Oosterschelde can be readily achieved in another manner. They believe the road from the north would only add to the damage done by the dams. It could turn the lowlands into a vast Coney Island. They believe that the promise of abundant additional supplies of water fit for farms and factories to use is a myth. They think that the Oosterschelde can be allowed to remain more or less as nature and generations of dike-builders fashioned it.

Just raise and strengthen the dikes protecting the hundred-odd miles of Oosterschelde shoreline, they say. Loeff's study group has calculated that this could be done for just about the same cost as that of completing the dam. The dikes along the northern shores of the Westerschelde have been strengthened, since the Westerschelde had to stay open, and nobody in the Rijkswaterstaat, says Loeff, believes that this expedient means that the people living there have been put in peril for the sake of the interests of the shippers of Antwerp. If a dike can protect the shores of the Westerschelde, then surely a dike is good enough for the next creek up the line. The coast road would be lost, but nobody claims that the new route is essential.

The men from the Rijkswaterstaat have, of course, assembled arguments to prove that the Loeff scheme is not so simple and satisfactory as it sounds. In the first place, raising the height of a dike means broadening its base. This would have to be done on the landward side and would mean that a fairly broad strip of levee land would be invaded by the banks, upsetting and unsettling a great many people. The land needed would have to be acquired by compulsory purchase. This involves legal haggling, which is possibly the most effective time waster yet dreamed up. Frank Spaargaren reckons it would take about a quarter of a century to do the job, and for that time the risk of a second disaster would remain.

Boelmans Kranenburg has an answer to this particular point. "Maybe you do have to take 300 houses or so," he says. "So what? If you drive a new road from the Hague to Utrecht you have to pull down far more than 300 houses—and we are always building new roads—we are road-crazy."

The water engineer has another objection to the dike scheme, and one which he is perhaps most qualified to hold. Over the past century at least (the period during which records have been kept) the deep channels in the mouth of the Oosterschelde (and there is one along either shore) have been scoured out by the tide and currents, and made deeper still. Their depth has increased by three or four feet since 1872, and, although this may not sound like a great deal, it means, in fact, that the estuary banks supporting the seaward side of the dikes are continuously being made steeper and washed away. Finally they can no longer support the great weight of earth and stone. The dikes then topple into the sea. "This must have happened a couple of thousand times in the last 200 years," says Frank Spaargaren.

So Jan Loeff's scheme may present problems, but he and his supporters point out that there is a deliberate and expensive deepening of channels by dredgers along the Rotterdam waterway in the north and at the mouth of the Westerschelde in the south. If deep channels flowing alongside dikes can be tolerated for the sake of supertankers, they argue, then why can't they be tolerated for the sake of nature?

Shutting a historic trade route

Also as an economist, Boelmans Kranenburg explains that, viewed against the background of the economic history of his country, the closure of the Oosterschelde is crazy, since the classic road between Holland and the rest of the world has been from east to west along such waterways. While striving to increase its international trade, the country is rapidly sealing off its trade routes.

There are more Dutch citizens killed on the roads each year than have ever been drowned by floods. So,

argues Kranenburg, the politicians cannot defend their data scheme on the grounds of the paramount duty to protect human lives until they have spent at least as much thought and energy and money on the business of reducing road deaths. As for the large sum of money already spent on the planning and setting up of the Oosterschelde operation, and on building those three islands—Kranenburg points out that it might all be recovered by turning the new territories into marinas, and places for fishing, water skiing, sunbathing and all the delights of the seaside.

What does the ordinary Dutchman think about it all? Kranenburg feels that few people care one way or the other. But among the people of the southwest lowlands there is a growing demand that the Oosterschelde should be saved. A recent Gallup poll showed that 60 percent of the locals wanted the waterway kept open. After the tragedy of 1953, everybody was in favor of any plan for keeping the sea at bay. Now a man who makes his living by selling delicious fried fish from a roadside stall, just above a row of oyster-washing tanks on the shore of the creek, says: "Keep it open—there are plenty of good fish there." It might be claimed that he had a vested interest in the matter.

A scientist and a lone politician

But perhaps one of the most persuasive advocates for an open creek is Dr. Vaas, if only because he started off as a supporter of the closure scheme and has changed his scientist's mind in the face of the evidence. Dr. Vaas believes the case for closing has not been convincing, and that the politicians have been overimpressed by the arguments of the engineers, and by the prospect for industrial gain. He does not claim to know the final answer to the problem, but he puts forward a most compelling case for a pause, so that a comprehensive study of the situation can be made in the light of the new knowledge, experience and understanding which have accumulated since the Delta Project was approved almost a generation ago.

At the moment, however, the government appears wholly indifferent to the doubts and objections which have multiplied so rapidly in the past few years.

Jan Terlouw has been a Member of Parliament for about 15 months. He is aged 40 and is by training a physicist, which gives him a severely logical attitude toward the delta plan which most of his parliamentary colleagues lack. "Some of our islands were inundated during the war when the dikes were breached by bombs. Now, once the Oosterschelde dam is built, the dikes will soon be allowed to go to wrack and ruin. At the moment they can hold back all but the most tempestuous seas. But once they have crumbled, a breach in the dam will inundate all Zeeland. Now,

Windmills rise over the locks near Wemeldinge on a historic water route from Rotterdam to Antwerp. Below, another Dutch tradition: The Oosterschelde dikes would become redundant.

what is the larger chance? War, or the kind of overwhelming tide and sea which occurs once in a thousand years? The dam is a sitting target for an enemy. Breaching it would be far simpler than breaking all the dikes. It is all so irrational—this claim that the delta plan must be completed for safety's sake. But rational arguments don't exist in politics."

Terlouw, a member of a small political party with little clout, claims that the quality of life in Holland is declining. "You see it everywhere. Twenty years ago you could enjoy a swim in all the lakes and rivers and canals. But not now. You go into the old cities, and it's a misery to walk around, because you have to spend your time trying to avoid destruction by the stinking, hurtling, noisy cars. We've filled the country with this damned dangerous metal.

"And the closing of the Oosterschelde is another large step backward. We shall be losing one of the things which makes life in Holland worth living."

If these reflections of Jan Terlouw seem largely irrelevant to the question of the closing of the Oosterschelde, in fact they are not necessarily. They express an attitude which caused him to ignore the political dangers of bringing up the subject of the Oosterschelde in Parliament and to challenge the minister in charge of transport and waterways to suspend further work on the dam, pending a new inquiry into the possible effects of the work and into the possibility of providing an alternative means for insuring the safety of the lowlanders against the sea. The minister told him that the decision had been made, and that there was no possibility of a change of mind.

There is one last way in which the last tidal creek of Zeeland might be saved. Jan Terlouw says: "We Dutchmen are very sensitive. So if the rest of the world thought us stupid in our handling of the Oosterschelde, it might help. We import all manner of goods because we always imagine that foreigners can make things better than we can. Of course, we know that the best waterworks engineers live right here, and we also like to win at football. But apart from these two things, we are very ready to be ashamed."

If Man is to survive as a species, we must quite soon accept the idea that every nation holds its realm in trust for all mankind, and for all future generations. The highly civilized Dutch might somehow be persuaded that the honor of their nation could be best served by pioneering this principle in the relatively minor matter of the Oosterschelde.

At the north end of the planned Oosterschelde dam, work progresses. Crews place willow mats which, when sunk, will stabilize the dam.

George Nakashima with the raw material of his craft: These magnificent slabs are all American black walnut, except for the one marked "1" and the one at the extreme right, both English walnut.

Photographs by Carl Mydans

By Miriam Plotnicov

A way to be free: Nakashima's life

Everything he does, from designing fine furniture to chopping trees, expresses his intent to live in harmony with nature

Nine low buildings on a wooded hillside mark the place where George Nakashima lives and produces some of the best hand-built furniture to be had in America, nine buildings made of wood and stone just off a road in rural Bucks County, Pennsylvania.

Although constructed at different times, Nakashima's buildings are harmonious. In each one he has experimented with a new roof design or has used industrial materials not available for the previous building, for the new is not rejected here even though much tradition is retained.

Open spaces between the shops, the showroom and the house are carefully landscaped; there are little pools, graveled paths and, under the large trees, smaller dogwoods to gleam in the spring sunshine. Down the hillside is a private museum (page 65) that houses the work of the late Ben Shahn. Farther on is a swimming pool. Even with the sounds of the workshops, it is quiet where Nakashima lives.

Most people think of him first as a designer, a fine craftsman in wood (a selection of his work is included in the opening exhibitions of the Smithsonian's Renwick Gallery in Washington). But to some, seeking a living pattern closer to basic truths, his way of life is more important than his furniture—and he would certainly agree.

Two traditions meet in George Nakashima, the son

The author, herself a craftswoman, helped organize the "Woodenworks" exhibit at the Renwick Gallery.

Nakashima beneath a blowup of a drawing by his great friend, the late Ben Shahn. He uses it as an identifying symbol in many exhibitions.

Some of the employees at work in the main machine workshop, the largest of several, in which they assemble furniture and do all the handwork.

of Japanese parents who settled in Spokane. His paternal grandfather was a practicing samurai who "fought up and down Japan with his sword." His father he describes as "one of the first students at Keio-Gijuko University, which was the beginning of Westernization in Japan. He was interested in freedom, so he came to this country. We went from complete feudalism to the jet age in two generations."

Nakashima was born in Spokane in 1905. He studied forestry at the University of Washington, switched to architecture, graduated in 1929, and a year later earned his master's degree in architecture at the Massachusetts Institute of Technology. "I went through the whole thing," he says, "except that I wasn't very satisfied with it." He worked for a while in New York City and read Spengler several times through. When he lost his job, he bought a round-the-world steamship ticket good for two years and left for Europe.

Looking for certain answers

In Paris he divided what was left of his money into twelve equal parts and intended to make it last a year. He read Nietzsche in French and Dostoevsky in Russian until he began to get hungry. In order to eat he worked as a house painter, a cook and, for a longer time, a printer in a music publishing house. Then he went to the South of France, where he picked up his steamship passage and continued his voyage, "looking for certain answers that I couldn't really find. I knocked around from country to country, got jobs, studied the language and lived pretty much as a native in various parts of the world. It was a very good way to gain some concept of what the world's about."

Eventually he reached Japan, where a friend of his father decided it was time for him to go to work again. Nakashima became an associate of the American architect Antonin Raymond, who had an extensive practice in the Orient. In 1935 a Roman Catholic chapel that Nakashima designed was completed in Karuizawa, and it was on this project that he learned at first hand the technical skills of the Japanese carpenter or "master builder." Then the Raymond organization was asked to plan a building for the ashram, or monastery, of the renowned Indian mystic Sri Aurobindo. Nakashima went to Pondicherry to design the building, a 200-foot-long reinforced concrete dormitory which they named Golconda for a city in Hyderabad.

Nakashima gave up his salary and stayed on for two years as a disciple of Aurobindo, living on the sparse but nourishing fare of the ashram. "I felt that I was finally being educated," he says, "I was arriving at something that gave meaning to my life." Directing the construction of Golconda and designing the simple furnishings needed for the dormitory rooms gave Nak-

ashima his earliest experience with integrated architecture and furniture.

The building was nearing completion when Nakashima made the difficult decision to leave the ashram and go back to Japan. There he met an American girl, Marion Okajima, who had been in Australia and was now teaching English in Japan. War was clearly approaching, so they returned to the United States and were married here. He had been away seven years.

Nakashima went back to the practice of architecture and with a friend made a trip along the West Coast to look at some modern houses that were then going up, including one by Frank Lloyd Wright. Of him, Nakashima says: "His greatest contribution to my life was that he made me aware of what not to do." By now accustomed to the exquisite carpentry of Japan and the skill that Indian craftsmen brought to woodworking, he was shocked by the quick and crude inner structure used even in these expensive, architect-designed homes.

He concluded that no one could finance the kind of architecture he believed in, so he began to design and make furniture instead. With furniture he could control the product himself from beginning to end, and thus preserve its esthetic integrity. But just as things were getting under way, the Japanese attacked Pearl Harbor. Nakashima, his wife and their infant daughter Mira were moved from Seattle to an internment camp at Minidoka, Idaho.

It was a traumatic experience. There was not much to do out there in the middle of an Idaho desert, but Nakashima set himself a project: "Taking all kinds of scrap lumber left over from building the barracks, we made what was called a model apartment. There was a very fine Japanese carpenter in the camp with me, so he and I got together. I was the designer and he was the cabinetmaker. I was both his superior and his apprentice." Bad as it was to be interned, it did give Nakashima the opportunity to learn the finer woodworking techniques he needed for making furniture.

From Idaho to Pennsylvania

Antonin Raymond had in the meantime left Japan and settled on a large farm in Bucks County. By guaranteeing Nakashima a job he made it possible for the family to leave the camp. Nakashima worked for a year as a farmhand; then, he recalls, "We decided to go off on our own, with something like $50, to do what we wanted to do. We felt that we had to carve our own environment and build our own lives."

The Nakashimas had come to the area at first only to escape the camp, but in time it seemed right for them and they began to look for a permanent place. A friend offered them three acres of land. A new work-

Nakashima's "Museum Mineuren" is named for an association of artists and architects in Japan, but is largely given over to the works of Ben Shahn.

The Conoid Studio, a name that means something to mathematicians, is the furniture showroom and the place where all of the design work is done.

shop went up. The house they had been renting was sold; since it was May and money was scarce, they moved into a large tent pitched on their own property. In the few hours left after a full day in the workshop, Nakashima began building a house for his family. "We have never had a mortgage since we started business here," he says. "If we had $50, we would buy $50 worth of material and start building."

Among other things, life in the tent was complicated by a lack of water. "We borrowed baths," he recalls, "or sometimes if we had a good rain we would shower. The trouble with that kind is that you might get yourself thoroughly soaped and the shower would turn off."

In retrospect these early years seem like a reliving of the trials experienced by America's first settlers. But by 1954, when his son Kevin was born, Nakashima's furniture was widely recognized for its outstanding qualities of design and construction. He got commissions, his work was exhibited in museums. To Nakashima the design itself is never the important fact—more important is a craftsman's respect for his material and a full command of the tools he uses. Fashion, a fleeting thing, is no consideration at all.

His collection of hardwoods, possibly the best of its kind in the world, is perhaps Nakashima's greatest material treasure. He likes to use pieces of wood another man would pass over, pieces that are beautiful but commercially of no value because they will not fit into standard milling and building procedures. "That's where our little contribution comes in. We just dwell in nature, live with nature and become part of it; and then we try to evolve something from it that's of utility and, if it turns out well, a thing of beauty."

A direct and harmonious relationship is shared with his 12 workshop employees, some of whom have been with him for more than a decade. There is no foreman and Nakashima leaves a good part of the shop management to the employees. He will admit, "I am a boss in a way," but adds that "everybody is working together. These men are free. They find what they are best suited for and kind of volunteer for it."

There is a steady flow of requests from people who want to work with him. Apprentices have been taken in from time to time, but from a practical standpoint it seldom works out: "The work is harder than it looks," he says. "You see, there's something of a tradition we have here. It's not a style—a style would soon be gone. It's a philosophy, perhaps a morality."

Working for a balanced relationship with nature is the cornerstone of Nakashima's life; to him, environmental concerns are not separate from the way a man lives each day. "At my age I have a 20-year plan to clean out the woods, cutting out dead trees. I spend generally an hour or two every day in the woods. It's very creative." He sees the slow but endless battle going on within nature in vivid terms: "Certain plants destroy others. These great oaks have deadly enemies, not only viruses and other diseases, but poison ivy and wild grape. They climb up a tree and pull it down, destroy it!" Ecologists, he thinks, are often sentimental—they see man only as the enemy of nature. But he believes that "nature needs man, too. The two have to work together."

A spiritual homecoming

In 1968 and 1970 two significant exhibitions of Nakashima's own work and that of his Japanese manufacturing facility on the Inland Sea were presented in Tokyo to enthusiastic acclaim. "It seems that in Japan there is great interest in what we are doing," he says. "In a way, we are going back to old Japanese traditions that Japan itself is moving away from. I look on it as a sort of spiritual homecoming, bringing the Japanese relationship to nature back where it started from. Lately the tendency has been quite the other way." What he means is that young Japanese designers are over-influenced by Western concepts, while fine carpenters are leaving their craft to earn higher wages building forms for prestressed concrete.

Nakashima accepts change and technology, however. But, he says, "We need the man who can set tools to a hundredth of an inch, who knows the keenness of the blade by the sound, who knows the thousand tactile values of each operation, and who is still an artist. This man must be intensely practical, as were the early settlers in this country, and yet full of faith and hope and aspiration as were the cathedral builders. There should be the sounds of actual activity, the whir of motors, mounds of white, clean shavings—the creativeness of work and tools. There is much work to be done and many people are needed to do it."

Nakashima watches his daughter Mira and
four grandchildren reveling in a Japanese bath.

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Smithsonian exhibit

Paleolithic man's rites of passage

The remains of hunters who lay buried for 30,000 years in a cave in Spain are on display briefly at the Institution

The discovery of Paleolithic human remains is a very rare event, and few prehistorians ever have the great good fortune to find deliberate burials from the Old Stone Age.

For that reason alone, the 30,000-year-old "corpse," now on display in the Smithsonian's National Museum of Natural History, is of special interest. Furthermore, found in a humid cave in Spain in a most unusual state of preservation (see below), it provides us with a rare insight into the sophistication of prehistoric man's burial practices. But also, only after the grave was laboriously excavated and brought to the Smithsonian Institution for the meticulous job of preparation and conservation did the archaeologists discover the tomb contained not one set of human remains but *two*.

In the late 1960s, L. G. Freeman of the University of Chicago and J. González Echegaray of the Provincial Museum of Archaeology and Prehistory in Santander, Spain, were jointly excavating a particularly rich site of Paleolithic human occupation, the Cueva Morín. Known since 1910 to be a significant archaeological area, the cave contained occupation levels dating as far back as some 40,000 or more years to what is called the Middle Paleolithic, when an industrial complex known as Mousterian flourished. In the same cave were horizons that bracketed several stages of the late Upper Paleolithic period.

Toward the end of the 1969 season, the two archaeologists were already quite content. They had significantly refined our knowledge of the Upper Paleolithic cultures of Spain. They had found not just one Mousterian level but several. In one of these the inhabitants had partitioned the cave with limestone blocks into two chambers. That same level contained a completely unexpected collection of tools made of bone rather than stone.

Then, in an early Upper Paleolithic level, they came across what seemed to be a dugout dwelling, complete with a hearth and stone tools, associated with four postholes. They next discovered two long trenches capped by mounds—graves almost certainly. One contained only dark organic earth and black buttery sediment: a disappointment.

In Spain's Cueva Morín, archaeologists found the shape of a hunter in the soil. He was buried on his side, arm flexed. After grave was removed en bloc, they found in it yet another man.

Early man's rites of passage

Clearing the sediment from the other, larger grave, Freeman's knife met an obstruction, a series of parallel ridges of dense earth. Flecks of severely decayed but recognizable bone began to appear in some of the ridges. It looked like the upper part of a human body —a flexed arm and a chest with sunken flesh between the ribs. This pseudomorph was called Morín I.

Instead of a skeleton, the archaeologists had found a "soil shadow" or pseudomorph of the dead man: As his flesh decayed, the hollow it left filled in with fine compact sediment, forming an earthen cast of the body that showed to the practiced eye the shape of muscle and flesh "in the round."

Once the upper surface had been completely cleared, it was apparent the dead man had been placed in the grave on his left side, his body extended with legs slightly bent. His head was concealed by another pseudomorph, the cast of a small hoofed animal, curled up in the way sheep are still trussed for market. Perhaps this and the ribs of another, larger animal covering his feet had been placed in the grave to assure the dead hunter of an adequate food supply.

In front of the lower legs of the dead man they found a small pit filled with bits of burned bone and fragments of red coloring material called ochre. The other smaller and empty grave (Morín II) had a similar pit beside it. The mounds showed evidence that ochre had been sprinkled over them, and a fire had been burned over the sealed graves.

The Morín I pseudomorph was made of exceedingly fragile sediment and the archaeologists intended to peel away the surface layer by layer and document the find as carefully as possible. This would inevitably have meant destroying it. However, a visitor to the site, Dr. Sol Tax of the Smithsonian's Center for the Study of Man, believed it could be preserved. Subsequently the conservation and preparation facilities of the Smithsonian Institution were put at the archaeologists' disposal and a host of local workmen began the laborious and delicate task of encasing and removing the grave from the cave.

From Santander, the encased grave was flown by a U.S. transport plane to Washington and sealed in a climate-controlled room in the Smithsonian's Museum of Natural History, lest it be exposed to drier air and start to crumble.

Two months later Freeman and Echegaray flew into Washington. The box was opened and everything was intact. John Widener of the Office of Exhibits Programs covered the pseudomorph with silicon rubber, not only so that plastic replicas could be made eventually from the mold, but to cushion the block when it was turned upside down so that the underside could be excavated.

After initial work on the underside of the block (carried out in the same climate-controlled room), they were stunned to find the hips and legs of another pseudomorph. Its lower legs, they discovered, had been cut off above the ankle and the stumps were charred. They labeled this burial Morín III and proceeded to scrape away the dirt around it, seeking the underside of Morín I. They discovered a cast of his head, separated from the shoulders by nearly ten inches, and, next to his neck, what they believe may have been the stone knife used to decapitate him.

Apparently, both Morín I and III's feet were cut off as well as Morín I's head. Similar postmortem mutilation is practiced among some living societies today, to prevent the spirit of the deceased from returning to haunt its old community and former fellows. And Morín I would have been a formidable ghost: Smithsonian anthropologists have estimated his stature at an unusually large six feet plus.

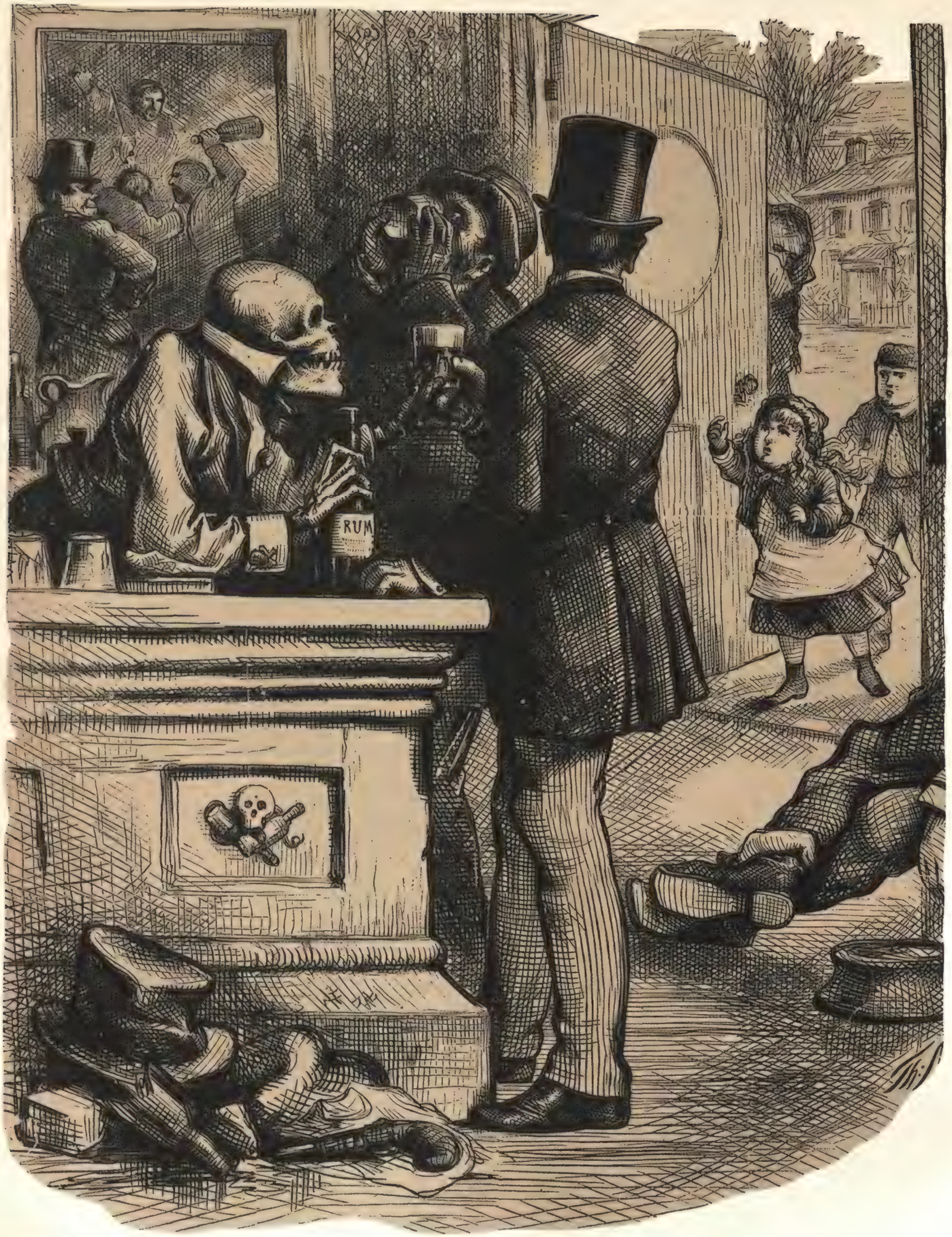
The fate of the hunters

Another rubber mold was made (of the underside of the burial) and Widener then proceeded to pour layer after thin layer of clear plastic over the entire block until it was completely embedded.

Replicas made from the rubber molds are displayed at the Smithsonian (opposite page). As for the plastic-embedded hunters, after spending this month on exhibition at the Smithsonian, they will be returned to the Provincial Museum at Santander, 12 miles from where they died and were buried with such elaborate care and precaution some 30,000 years ago.

This report was prepared from scientific information supplied by Dr. Freeman and Fr. Echegaray.

Above are casts made of top of the grave, and (left) the underside. Morín I impressions were painted dark gray; light brown object (right) is hoofed animal trussed and buried with the hunter.



Demon Rum rules the saloon subculture of the 1870s in this Thomas Nast cartoon. Such scenes inspired "Father, dear father, come home with me now."

By Albin Dearing

Return to the bad old days of the 1870s? No thanks

As we plan for our Bicentennial we abhor our social evils—yet 100-year-old sources recall worse crime and corruption

In the planning stage now is the Bicentennial, the 200th anniversary of our independence. The President urges us to scrutinize ourselves at this time, to establish our land as a showplace for foreign visitors. Had such self-examination taken place a hundred years ago when we were preparing for our Centennial of 1876, we might well have questioned whether the country was worth the celebration.

We think of Victorian America as orderly, blissful, innocent and uncomplicated. Determined to recapture its antique charm, we uproot the television, disconnect the radio, tear out the telephones and stop the news magazines. Away with the present! It's back to bustles and bicycles, celluloid collars and Currier & Ives prints, a hand pump in the sink and a swing on the porch. Thus surrounded with elements of that better life of yesteryear, can we not again attain it?

Better to forget it.

Violence in the streets? But . . . the United States of the 1870s had a crime rate perhaps twice that of today. There was rioting among the Irish in New York, the blacks in Savannah, the Chinese in San Francisco, the political clubs in Pittsburgh and the coal miners in Scranton. Indians scalped the wagon-master of a government mule train in the Colorado Territory. Corruption in high places? Well . . . New Yorkers were discovering that Boss Tweed had mulcted them of millions. Legislators were being bought and sold by powerful capitalists. Graft reached into the White House itself.

About a sixth of the population was foreign born, largely unassimilated and incomprehensible. Thousands of children, aged eight, were recruited to the ten-hour work day of factories, mines and sweatshops.

Traffic hopelessly clogged city streets by day, toughs roamed them by night. Prostitution plagued urban centers and venereal disease raged.

Pneumonia and tuberculosis ravaged the population in winter, malaria and typhoid in summer, diphtheria, scarlet fever and sometimes cholera and smallpox in all seasons. Public health, like inside plumbing and sanitation, concerned only a few.

Gangs of Ku Klux Klansmen whipped, tortured or murdered hundreds of blacks. The U.S. Navy shelled the coast of Korea, with which we were at peace. And our most violent enemy, fire, all but obliterated Chicago in 1871, gutted Boston in 1872 and sent 1,100 barrels of whiskey up in smoke in Nashville.

This was a time when a million Americans were trekking westward—many to fall victim to Indians, desperadoes and the fraudulent schemes of their fellows. These scoundrels left the Ten Commandments on the east bank of the Missouri to rely on boozing magistrates for law west of the Pecos. It was a time when women could not practice law in most states or Mormons serve on federal grand juries in Utah. Spiritualism, with 95 congregations and thousands of adherents, was a thriving religion. Such towering tycoons as Commodore Vanderbilt and J.P. Morgan kept pet mediums to give them financial tips. The propriety of Bible reading in the public schools was questioned, folks complained at the high cost of funerals while staging great religious revivals that lasted all day and far into the night and left waves of arrests for drunkenness in the cities and a precipitous increase in illegitimacy at the crossroads.

As the nation approached its first hundredth birthday, some daring women were wearing men's clothing. Newspapers carried stories of women footracing through Central Park in practically no clothing at all, dancing the can-can in the New Jersey surf, getting married on velocipedes, playing football on stilts, capturing criminals, smoking cigarettes seated in their windows at swank Saratoga, hitting bears with axes or each other with bare fists in the prize ring, and riding behind their men on bicycles "though it creates invalids as well as fallen women." Two women in Philadelphia sold their hair for a rail ticket, and at least once two others auctioned off a man.

At the University of Michigan, women demanded and won admission to men's classes. In Brooklyn, they invaded railroad smoking compartments. In Virginia

Albin Dearing, a retired Army officer who has turned to historical themes, lives in Florida.

Life 100 years ago

City, Nevada, the town belles organized an opium smoking club. Everywhere girls affected a hairdo that cascaded over their eyes. Inevitably, it was called "the lunatic fringe." And everywhere they wore shiny pie pans stuck in their wide belts. In jockey silks, Miss Julia Bishop won at Mannsville, New York, while in Manhattan Miss Mary Marshall and Miss Bertha von Hillern ran a six-day miniskirted marathon. At Omro, Wisconsin, a young lady with obvious talents for judo neatly tossed a male into a snowbank for molesting her while skating.

Young men went clean-shaven in contemptuous disdain for their elders' hilarious muttonchop whiskers, straggly handlebar moustaches, imperial goatees and shoulder-length hair.

Not that the clean-shaven young men of 1872 had no idiosyncrasies. When not racing about on bicycles to the dismay of horses, or sassing their reproving elders with "Aw, mind your bustle!" they were showing an early predilection for strong drink. Police in New York arrested a 13-year-old for heaving a brick through a saloon window because the bartender refused to serve him.

There is no reason to think that the young and their elders of that day were closer than those of today. In that aftermath of the Civil War, America's youth was asking questions and not getting satisfactory answers. The elders' concern for morality focused for awhile on youth's preference for the "story papers" and the half-dime novels then so prolific, filled with tales of crime, love, horror and adventure. Anthony Comstock, founder of the New York Society for the Suppression of Vice, shrieked that "These stories breed vulgarity, profanity, loose ideas of life, impurity of thought and deed. They render the imagination unclean, destroy domestic peace and make foul-mouthed bullies, cheats, vagabonds, thieves, desperadoes, libertines. They disparage honest toil and make real life a drudge and burden."

Comstock may have found vicarious enjoyment in accompanying police on brothel raids, but he plucked a true chord with that last phrase. Life was indeed a drudge and a burden and fast becoming intolerably so as craftsmanship gave way before demands for mass production—simple actions endlessly repeated. Given half a day free each week, what escape was there for automatons of the factory and seamstresses of the sweatshop on starvation wages? In the decade of the 1870s, alcohol probably made converts faster than at any other period in our history. As did opium.

Yesterday's drug culture

Today's "drug culture" had its counterpart in the America of 1872, only then it was more widespread in respect to areas and age groups. In 1872, Florida, New Mexico, Texas, Vermont, New Hampshire all grew poppies for our thriving opium production, though we imported a sizable tonnage of it.

Laudanum, tincture of opium, was the fare of our "opium eaters" and was sold in drugstores and many grocery stores as well. Few Conestoga wagons had gone west without their casks of laudanum for use as a painkiller for sufferers from rheumatism, for insomnia and for anesthesia.

In England opium had provided dream worlds for Coleridge, De Quincey, Crabbe, Keats, Wilkie Collins and Francis Thompson. Alethea Hayter tells us that in the textile districts of Lancashire "the counters of the druggists were strewn with pills of one, two or three grains in preparation for the known demand of the evening. There was not a village in the region but could show at least one shop and its counter loaded with laudanum vials, even to the hundreds, for the accommodation of customers retiring from the workshops on Saturday nights."

In America, commerce in opium had formed the base of more than one great family fortune. It was given to babies when they cried in Mrs. Winslow's Soothing Syrup and to suffering adults in Dr. Olcott's Pain Annihilator or Radway's Ready Relief. Lydia Pinkham's famed Vegetable Compound relieved millions of "female ailments" partly because, as was found many years later, the good lady's herbs contained small amounts of then-unknown estrogens. But a good measure of relief came from the fact that the mixture was 21 percent alcohol.

Some of the most famous catarrh remedies depended on cocaine; stomach bitters favored rum or brandy. The widely sold tonic Peruna had about the same kick as a Manhattan cocktail, and a watchful Bureau of Indian Affairs learned to prohibit its sale on Indian

A ten-year-old girl, wistfully staring from the window of a textile mill, speaks volumes about child labor.

New York's air pollution a century ago: The smell was worse than today (except when there's a garbage strike) , but the effects weren't as frightening.

Rampant crime on the streets inspired this fanciful sketch of armed and aroused citizens.

reservations. During subsequent investigations, Mark Sullivan estimated that Americans had been drinking more alcohol in patent medicines than in all licensed beer, liquor and wine sold in the country.

The enormity of America's drug addiction, all so innocent, awakened no public outcry and but little medical interest. Not until 1881 was the import of opium *from China* prohibited, though the bulk of our manufactured products came not from China but from England and Germany. Few 19th-century Americans had not tasted opium in some form; some middle-class and many working-class children died from it.

To criticize the medical world for its ignorance would be unfair. Many a man during the Civil War and after had a gangrenous arm or leg chopped off with no more than a stiff dose of whiskey. In the surgeon's endless quest for anesthesia, morphine, codeine, heroin were blessings. If addiction flowed from the physician's kit it was because he believed that "opium diminished the determination of blood to the inflamed parts." Lingering in the pharmacopoeia were ancient alchemies. In the late 19th century, one druggist's compound began, "Take tenpenny weight of wax from the ear of a dog. . . ."

America's malaise of the 1870s disturbed its sociologists and men of medicine alike. Dr. George Beard's *American Nervousness, Its Causes and Consequences,* published in 1881, reflects the concern of thinking men that neuroses were the result of an industrial civilization, and were specifically induced by such factors as steam power, the periodical press, the telegraph, the sciences and "the mental activity of women."

For all their antics, ever-questing American youth showed disposition toward a societal isolation, intellectual in scope, tribal in appearance and rites. They rallied around Transcendentalism which New Englanders were refining from Kant, Fichte and Hegel, just as today's young people take on the beliefs and robes of the street Buddhists. Yet most had normal tendencies: One Octavius B. Frothingham saw dread consequences in the young peoples' method of dancing. "Over excitement is produced from the commingling of sexes in warm rooms where the mind is unbalanced by the wild delirium of the waltz."

In 1872 life was pretty much touch and go for the city dweller. That nation of 40 million had nothing approximating today's 50,000 annual highway fatalities, but its other disasters were proportionately greater. Fire was the great killer, since so many structures were of wood. Perils of the sea were real and familiar, for ships had no devices to warn of approaching storms. The land travelers' lot was no better. Almost every day brought word of trains stranded in snowbanks, head-on crashes, death at the crossing and derailments. No one hopped on a train for any distance without a bit of terror. High speed along badly

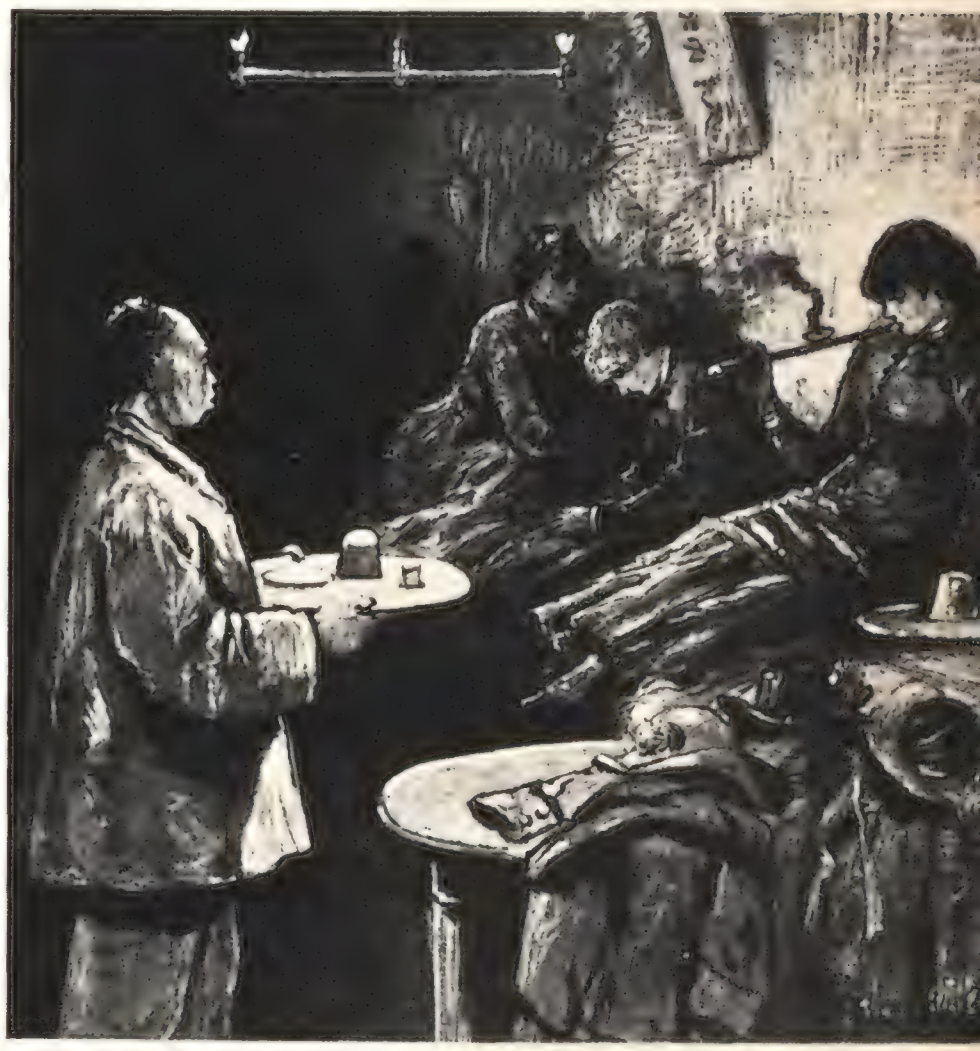
The Ku Klux Klan strikes in the night. Although officially disbanded by 1871, its members rode the Reconstruction South, terrorizing the blacks.

ballasted rails killed many in the 1870s. A rear-end collision just outside Boston took 29 lives, including that of the minister of the Arlington Street Church. In 1872, a bridge collapsed near Prospect Station, Pennsylvania, and 25 died. A few years later, near Ashtabula, Ohio, another wobbly bridge—plus a snowstorm and high winds—sent a train plunging to glory with 80 killed, 60 injured.

As for traffic problems, the headache of our own age, let James Buel describe a New York visitor's emotions in the 1870s: "If he should desire to cross the street a thousand misgivings will assail him, for although he sees scores of men and women constantly passing through the moving lines of vehicles. . . . a stranger will suffer the pressure of a hurrying and jostling crowd on the sidewalk for an hour before plucking up sufficient resolution to attempt a crossing."

Manners? But . . . that was the United States where Americans had just completed the organized slaughter of fellow Americans in our costliest war. Could the half-million immigrants dumped into America in 1872 be expected to improve the demeanor of that society?

There was another side of the coin. As we see today among our youth, the 1870s experienced a return to religion. No flashback would be complete without a look at Dwight Moody. America has seen many evangelists come and go. But in that turbulent America of a hundred years ago, huge crowds in New York, Bos-



New York working girls puff opium pipes in a Pell Street den. Drugs, especially laudanum, were a more widespread problem than today.

ton, Philadelphia and Baltimore came to hear an unimpassioned, undramatic, unstylistic but never uninspired, lay preacher, a former Chicago shoe salesman, talk of Jesus Christ. What Dwight Moody said carried no threat of hellfire and damnation, no shrill condemnation of this corrupt and doomed civilization. "I don't want to scare men into the Kingdom of God," he said.

If among his hearers there were regular churchgoing Christians, Moody might politely invite them to stay away. If he should see that through the power of his biblical interpretation some among his hearers were being swayed, Moody might stop dead. That was Ira Sankey's cue to play the organ and give forth with song. Moody distrusted mass emotions. He was no spellbinder; at times he did not even speak clearly.

Newspapers could only express bewilderment over the popular excitement that Moody aroused. A man of little education, his sermons have been called "a collection of rather dull anecdotes and trite theological observations." Yet in a single Sunday, the *New York Herald* reported that 15,000 people jammed his opening meeting in Flatbush.

Such then was this America of a hundred years ago when Congress met to discuss financing the Centennial. Wounds of war, sutured, healing, at times were maliciously rubbed with salt. The "bloody shirt" was waved anew in the elections of 1872, the North reminding of the horror of Andersonville, Southerners chafing under Reconstruction. In that year Boston staged a monster peace jubilee, then saw its city fathers off on a train to Philadelphia to inspect plans for the celebration. Like New Jersey, Boston then threw her influence behind the idea. Pennsylvania and the City of Philadelphia put up a million and a half dollars. Now needed was another million and a half from Congress.

In that day the federal government stuck more closely to the business of governing, indeed the whole federal budget was but $278 million. Obviously a centennial celebration presented an opportunity to close ranks North and South in shoring up the people's pride in what the entire nation had accomplished since 1776. Nevertheless, members of the House of Representatives, while fully in accord with the sentiment, were not unanimous in agreement that a centennial exposition was the best means of serving it.

Congressman Benjamin Willis of New York protested the cost—"While we are celebrating the birth of the Republic let us take care lest we contribute to its burial"—and complained about the growing complexity of government in terms that seem familiar today: "Its functions have been indefinitely multiplied. It has built railroads; become parent, teacher, master, banker; and now it proposes to go into the show business. . . ." He preferred, he said, to "bequeath to our posterity the privilege of celebrating the continued existence of the Republic in 1976."

At length the argument was resolved by William Phillips of Kansas: "The nation that has spent four millions a day in war can afford a million and a half once every hundred years to render civil wars impossible." Among so many similarities between today's troubled times and those of a century ago, perhaps this ideal for a Centennial can also be repeated.

Dwight Moody, shoe-salesman-turned-lay-preacher, packed concert halls with his religious services.

An artist's suggestion for a people-hoisting derrick to cope with clogged city streets of the 1870s.

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Book reviews

Lame Deer, Seeker of Visions
John (Fire) Lame Deer and
Richard Erdoes
(Simon and Schuster, $7.95)

His face wrinkled like the Badlands, his eyes focused on things beyond—or within—Lame Deer strikes a trancelike pose before his sacred star blanket. In words edited by writer-artist-photographer Erdoes, the old Sioux recites a past as checkered as his quilted blanket, indicating along the way the white man's lust for the green frog skin—the dollar bill. Lame Deer grieves that his sacred Black Hills have become a vast Disneyland, and his holy Mount Rushmore a giant paperweight banked with rubble. "Can you make it into a wild, natural mountain again?"

When still a boy he huddled in a pit atop a hill for four days and nights. A vision came. He walked down the hill not only a man but a medicine man, a *wicasa waken* attuned to voices of nature and possessed by a dream. "I could cure you," he claims, "with a drink of pure cold water and the workings of my vision. Not always, but often enough."

A white man knowledgeable about Indian ways once remarked [to me] that if an Indian woman was going to have a baby, she went to a hospital; if she had a virus, she got a shot; if she was worried, she sent for a medicine man. That suggests a medicine man may be as adept at psychotherapy as his college-trained counterpart, the main difference, as Lame Deer implies, being about $35 an hour. He speaks of medicine good and bad, of dances and songs and healing herbs, of the power of the peace pipe. He does not tell all, for there would be no more mysteries. "Man cannot live without mystery. He has a great need of it."

Indian life too long has been a mystery to invading whites, too long misunderstood, too long ignored—or punished. This book enlightens as well as entertains. Its earthy candor, at times almost farcical, at times seemingly irreverent, is as refreshing as feeling snow on your face. Erdoes, born in Vienna, raised "in the shadows of gargoyled cathedrals," and, as he admits, "predisposed to love Indians" (thanks to American Westerns), has shaped the book into something not his own—not even its photographs. For it, and they, are wonderfully Indian.
—*Wayne Barrett*
Writer and artist—one-eighth Indian

Those Damned Rebels
by Michael Pearson
(G.P. Putnam's Sons, $8.95)

In his foreword Pearson asserts "that the book often reveals facts *as they were learned at the time* by the British. . . . Because the perspective of the book is British, I naturally favor the British versions." Thus, presumably, Brooklyn is "Brookland," the Wyoming Valley in Pennsylvania is merely—and confusingly—"Wyoming," and Nathanael Greene's rebel army of 4,400 in the Carolinas is put at 10,000 men and "growing daily."

Less excusable is the botching of the name of the Continental Congress president, Peyton Randolph, whom Pearson insists repeatedly (thrice on a single page) is Randolph Peyton. And is the author aware that the "Colonel Washington" at Cowpens was William and not George? If so, he fails to make the distinction—a curious inconsistency since he clearly defines which Howe was a British general and which was an admiral. But in this book, purporting to tell the story of the American Revolution "as it was seen through British eyes," General George Washington is glimpsed myopically when at all. The author bestows his highest accolade upon another American general—Benedict Arnold.

The information Pearson gleaned from British letters and documents provides interesting insights on the Revolution. George III comes across as a well-meaning king who burned the midnight oil penning memos to his ministers. Sir Henry Clinton is shown as a talented if petulant strategist, not the lusty lazybones stereo-

Photo of actual ranchland taken at Sangre de Cristo Ranches

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typed in many American histories. Pearson adroitly traces the transformation of General Burgoyne from easygoing "Gentleman Johnny" to "temporarily unbalanced" bungler.

He reveals that British officers regarded British soldiers almost as animals, and marched them in close ranks, "like packs of hounds," in order to control them. To the detriment of his book, Pearson lets personal prejudice crowd out objectivity. His distaste for Samuel Adams reduces him to name-calling—demagogue, riffraff, Machiavellian. Adams and his New England cohorts "sparked off the rebellion," asserts the author, by broadcasting "false reports" of British barbarity. In other places, the author himself chronicles the kinds of incidents Adams decried: "Angry [British] soldiers rushed house after house, killing everyone they could find inside. . . . None of the generals . . . ever succeeded in stopping looting. . . . 'A girl cannot step into the bushes to pluck a rose without running the most imminent risk of being ravished.' "

Pearson uses newspaper-style datelines for chapter headings, picking a time and place—such as "London, September 3, 1777"—to launch a spate of narrative. Six London datelines—out of 23—give the book a not uninteresting focus.

The writing ranges from vivid to vacuous. One line manages to be both: "Hundreds of oarsmen dropped their blades into the water and heaved." Unfortunately, Pearson writes history as it frequently is written. Carelessly.

—Lillian Moore
Writer on history and conservation

O Congress
Donald Riegle with Trevor Armbrister
(Doubleday, $7.95)

The inner workings of the U.S. Congress are difficult to describe. Of the many unreadable books about it, few have interested anyone other than political scientists. But now Donald Riegle, a controversial young member of the House, has written what outwardly appears to be an exposé but what develops as a most illuminating book on an institution which affects our every action.

The independent Riegle clearly does not accept the role designed for young legislators: "You get along by going along" with the party leadership. He feels compelled to go his own way on various issues and has discovered that many doors of access are difficult to open, and that the reactions of friends, colleagues and supporters can be surprising.

Riegle narrates in diary form the mysterious ways of the House of Representatives, what happens in committee rooms and on the floor. He makes the ultimate statement on appropriations: "Other committees write laws and devise new programs—our job is to divvy up the money. This gives the subcommittee chairmen considerable power and influence. The committee itself has to work on the basis of accommodation. . . . We accommodate ourselves right down the drain."

Whether describing persistent constituent demands on his time, or the peculiarities of his colleagues, Riegle maintains a sensitive and enlightened touch. He explores the frustrations of charting an independent course. It is rare when he is able to feel that "the system's constraints had failed to function properly and I had been able to accomplish something."

An additional dimension is Riegle's ability to write with compassion about his children, falling in love and a new marriage. These subjects are off limits to most politicians but in Riegle's case, they seem to mirror what everything else is all about. His ability to feel is an astonishing admission in the hard-nosed business of big-league politics.

St. Augustine began confessional writing, and recently we've had a number of books like Jim Bouton's *Ball Four* by professionals who have looked candidly and honestly into their careers. Now *O Congress* must be added to these, and for it we are grateful to the courageous Republican member from Michigan.

—William F. Claire
Editor of *Voyages* and former Congressional aide

The Cod
Albert C. Jensen
(Thomas Y. Crowell Co., $7.95)

The normal first reaction to a book so titled is that it probably tells you more than you want to know about codfish. You might be surprised. This charming little book presents a veritable fish fry of cod superlatives in such an urbane style that in the end the writer, a marine biologist, persuades you that the ultimate superlative stated in his opening sen-

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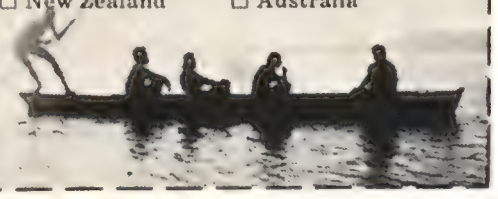

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Arun Valley–Nepal: 10 February/2 March 1973–An ecological study of the flora and fauna of an uninhabited and unexplored forest in the eastern Himalayas, Nepal–Mr. Jeffrey McNeely and Mr. Edward Cronin, Jr.–Association for the Conservation of Wildlife, Bangkok, Thailand

Information concerning the full program for the spring and summer of 1973 can also be obtained by writing the above address: Africa, Israel, Bermuda, Greece and Latin America will be the destinations of these expeditions.

tence is true: "Since before the beginnings of written history, one fish above all others has had profound effect on the social and economic structure of the peoples of North America and Europe."

The colonization of New England by the Pilgrims was caused less by a desire for religious freedom, Mr. Jensen suggests, than by a lust for profits from the offshore fisheries. In the author's grab bag of facts, note: In 1970, fishermen caught enough Atlantic cod to provide four servings for everyone in the world. Americans eat about 11 pounds of fish a year, one pound of it is cod.

The biggest cod recorded by the International Game Fish Association is a 98-pounder caught in 1969. But in May 1895 the "Patriarch Cod," caught off the Massachusetts coast, weighed in at 211½ pounds. Theoretically, cod can live to 50 years, though few make it to 25. They swim at up to four miles an hour and apparently will eat anything, for their stomachs have yielded jackknives, boots and false teeth (consider some wretch losing not only lunch but dentures).

In one poignant case, a woman's wedding ring lost 10 years before in the drowning of a shipwreck victim was retrieved from a cod's stomach. The victim's son received the memento and generously rewarded the fisherman.

Closing chapters sound the inevitable note of alarm about dwindling resources, especially since the arrival of vast Soviet trawler fleets and the ships of 19 other nations on the North Atlantic fishing banks. Jensen quotes a drastic proposal to ban trawling in certain areas.

A Newfoundland fisheries expert once suggested to me a simpler solution: "When the cod get so scarce there's no profit in coming so far to fish them, all the foreigners will finally go home and we Newfies will still be here, sitting on top of the Grand Banks. . . ."

For anybody with even a glimmer of interest in fisheries or the cruel sea, I recommend this book.

—Bern Keating

Free-lance writer, author of *The Grand Banks*

The War for the Cities
Robert Moss
(Coward, McCann & Geoghegan, $6.95)

Violence in the cities in the 1970s is going to get worse before it gets better, predicts Mr. Moss. Putting urban guerrilla warfare into global context, he analyzes the appeal, origins, goals, strategies, successes and failures of contemporary terrorist organizations. He finds no international conspiracy; but he does find areas of kinship among the leather-jacketed Black Panthers, the trench-coated Irish Republican Army, the javelin-throwing Naxalites of West Bengal, the Front de Libération du Québec and the various organizations in Uruguay, Brazil, Argentina, Venezuela and Guatemala. Indeed, the book is heavy on terrorism in Latin America, an area in which Moss, a writer for the *Economist,* is a specialist.

Moss catalogs demonstrations, kidnappings, assassinations and bombings that have become a staple of world headlines. Urban wars, he says, have supplanted Marxian-oriented "people's wars" and rural uprisings that followed World War II. He argues that this kind of warfare "is likely to develop into one of the most prevalent forms of political violence in the decade of the 1970s, and it may spread to many Western cities that were formerly considered immune to the contagion."

He views cities as particularly vulnerable to primitive terrorist tactics: the destruction of an office building by a box of kitchen matches tossed into the air-conditioning system; spectacular collisions by handfuls of tacks scattered at traffic intersections. But it is not possible physical disruption that disturbs the author. He fears their constraining effect on foreign policy, already illustrated by Britain's transfer of troops from the Rhine to Ulster. Even more, he fears overreaction. ". . . The urban guerrilla is dangerous less for what he does than for what he inspires: the breakdown of moral consensus in a society, the hardening of the political battle lines, and a right-wing response that sometimes hits back too hard and too erratically."

The War for the Cities is not, Moss says, a "how to bash them" book. Rather, it is a thoughtful analysis of a contemporary crisis. If there is little particularly new in it, nevertheless the author has pulled together tangled strands and woven them into one story. If the book has a fault, it is too much discussion of containment-repression and too little of the conditions that gave rise to the urban guerrilla bands.

—Liva Baker

Journalist, biographer and urban dweller

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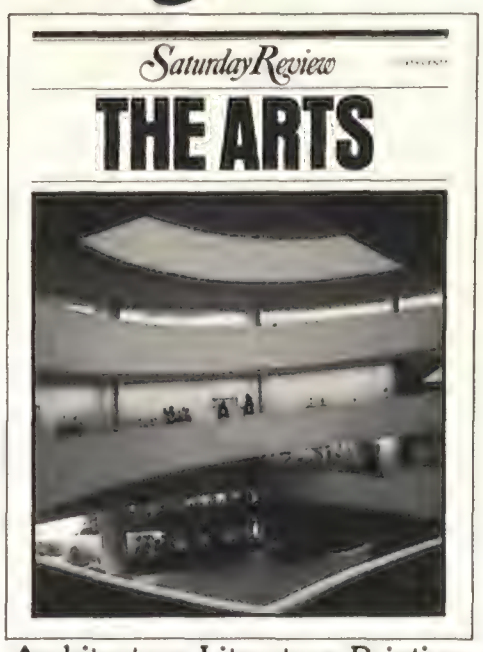

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—You'll read John Hightower, former director of the Museum of Modern Art, on how tax dollars are revolutionizing museums, changing them from private clubs for connoisseurs to vital public institutions. You'll also see the sleek new products that the Italians are designing for your home.

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—What does Glenda Jackson plan to do next? What films are Costa-Gavras and the man who made *El Topo* already shooting?

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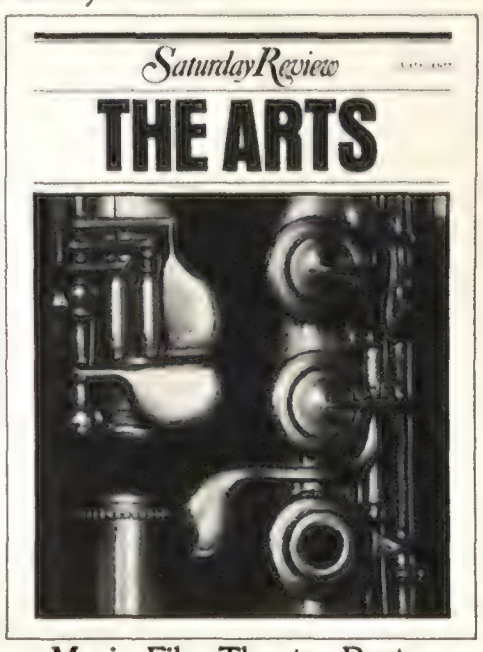

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Olympic National Park: Explore the botanic progression of the rain forest and the geology of the park; take side trip to the Makah reservation and Victoria, B.C.—September 16-22.

Instruction in Photography: Field instruction and experience in Maine, covering such subjects as landscape, mills, old farms, villages and coastal areas—September 24-29.

Arizona Astronomy Weekend: Introduction to general astronomy and the Smithsonian's Mt. Hopkins Observatory and other research facilities in the Tucson area; includes status report on current American astronomical research—October 6-9.

Blockade-Runners' View of the Carolinas: Coastal traverse, including visits to a shipwreck and maritime collections—October 21-27.

Sanibel Island, Florida: Explore the life of a barrier island, from the bird-filled wildlife refuge to the shell-strewn shores along the Gulf of Mexico—November 5-10.

Nature's Past: A view of the preserved natural areas of Florida's west coast, starting on Sanibel Island and ranging from the flood plain valley of the Myakka River through jungle and cyprus swamp to the Everglades—November 12-19.

Christmas at the Smithsonian: Second in a series of weekends for National Associates, designed around activities at the Smithsonian and other areas of interest in Washington, D.C.—December 15-17.

Smithsonian highlights

Museum of History and Technology
"The Atlantic Cable" evokes through paintings, photographs and artifacts a technical triumph—the first undersea cable which linked North America with Europe in 1858.

"Right to Vote," from Colonial times to the 26th Amendment, shows the trend toward a more inclusive suffrage.

"Sculpture in Light and Motion" created by Adam Peiperl is art in physics, featured in the Physical Sciences Lounge.

"Mutoscopes," one with a Plexiglas side to reveal its inner workings, feature early Edison newsreels and naughty (c. 1905) flip-card shows.

National Portrait Gallery
"Red Groom's Sculpture of Dave Scott on the Moon" depicts the commander of the Apollo 15 mission in an 11-foot-tall work of wood, cloth, acrylic and plastic. Opens mid-September.

National Collection of Fine Arts
"The Way of Good and Evil: Popular Religious Lithographs of 19th-century America" includes 56 prints based on biblical scenes, moralizing themes and the temperance movement. Opens September 15, Prints and Drawings Gallery.

"The Hand and the Spirit: The Religious Impulse in American Art, 1700-1900" features more than 120 paintings and sculptures representing biblical events and characters and the 19th-century notion of Man's oneness with nature. This is the first major exhibition ever held documenting specifically religious intent in American art. Opens late September, Special Exhibition Galleries.

Museum of Natural History
"The Shadow of a Stone-Age Man" sheds light on a culture 30,000 years old, with unique soil shadow (three-dimensional body cast) of Paleolithic hunter (pp. 69-71) found in northern Spain and grave offerings with which he was buried.

Division of Performing Arts
"An Election-Year Extravaganza for Children" opens at the Smithsonian puppet theater September 13. Performances are at 10:30 and 12:30, Wednesday through Friday, and at 10:30, 12:30 and 2:30, Saturday and Sunday. Call (202) 381-5395.

Arts and Industries
"The Flying Tigers" features portraits and memorabilia of the American Volunteer Group (AVG), commanded by General Claire L. Chennault, which flew under the Chinese banner and was the forerunner of U.S. planes in the Pacific theater in World War II.

"Air Force Art" depicts in a rotating collection of paintings the activities and personnel of this U.S. military unit.

Anacostia Neighborhood Museum
"Evolution of a Community II," the second in a series of exhibits on Anacostia, deals with problems of the community: unemployment, housing, education, drugs and crime. Opens on the fifth anniversary of the museum, September 15.

Freer Gallery of Art
"Recent Japanese Accessions" is a special exhibit in honor of the Japanese-American Citizens League.

Renwick Gallery
"Sculpture of Franz Barwig," sponsored by the Austrian Institute, features 21 works in bronze and wood by the Viennese sculptor.

"The Avant-Garde in Theater and Art: Playbills of the 1890s" includes some 75 19th-century programs created for the experimental Théâtre Libre and Théâtre de l'Oeuvre by Lautrec, Bonnard, Vuillard, Munch, Signac, Denis and others. The styles of the programs reflect the differences between the two theaters. The

exhibition will be circulated nationally by the Smithsonian Institution Traveling Exhibition Service.

Cooper-Hewitt
During reorganization at this New York City museum, a series of hour-long films on urban design is being projected on the fence surrounding the museum.

Smithsonian Building
"New England Textile Manufacturing" illustrates with artifacts and photographs the history and development of the textile industry and its related architecture during the 19th century. Included are: original samples of fabrics, patent models for mill machinery and an actual loom.

Traveling Exhibition Service
There are up to 70 different Smithsonian-sponsored exhibitions on display each month throughout the United States and Canada. For a complete listing and information on how to bring an exhibit to your area write: Traveling Exhibition Service, Smithsonian Institution, Washington, D.C. 20560.

- Midland, Tex.—"Art Protis" (Museum of the Southwest, Sept. 9-Oct. 8).
- Worcester, Mass.—"The Color of Man" (George F. Gordon Library, Worcester Polytechnic Institute, Sept. 2-24).
- Austin, Tex.—"The Art of the Comic Strip" (University of Texas Art Museum, Sept. 9-Oct. 8).
- Detroit, Mich. — "Computer Technology" (Detroit Historical Museum, Sept. 2-Nov. 26).
- Senatobia, Miss.—"Prints and Drawings by Lovis Corinth" (Northwest Mississippi Junior College, Sept. 2-Oct. 1).
- Dallas, Tex.—"The Dead Sea Scrolls" (Dallas Public Library, Sept. 9-Oct. 8).
- Muscatine, Iowa—"The Story of a Goblet" (Laura Musser Art Gallery and Museum, Sept. 9-Oct. 8).
- Bloomfield Hills, Mich.—"Greenland: Arctic Denmark" (Cranbrook Institute of Science, Sept. 2-Oct. 15).

Smithsonian Commons
Luncheon facilities for members of the Smithsonian Associates are located in the original Smithsonian Building. Open weekdays from 11:30 A.M. to 2 P.M., the Commons offers a buffet luncheon from $1.40 to $1.85 upon presentation of a membership card.

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By Patrick Ryan

Compulsive cleanliness may send us down the drain

Just on the market at $6,600 is a somewhat egg-shaped washing machine in which a human being reclines, to be flushed with hot water, massaged by rubber spheres and dried under infrared rays. In Texas, a student claims the world sluicing record—169 hours in the shower. Meanwhile, in Palm Springs, a well-heeled decorator has designed a $22,500 bathroom. It's so sumptuous that, he says, once inside, "I'm so thrilled to be there that I hate to go out." And in Tokyo, there's a hotel with a solid-gold bath available at 1,000 yen a quick dip, in the local belief that a two-minute dunk will add three years to your life.

Saintliness, however, was early on the side of the great unwashed. St. Benedict decreed that "to those that are well, and especially to the young, bathing shall seldom be permitted." This may have been the reason that the Benedictines became known as the "Black Monks." St. Agnes, martyred patron of young virgins, went to glory in a spiritual odor of sanctity although physically she had never washed her body in all her 13 years. St. Jerome rebuked his followers for keeping themselves too clean. St. Francis of Assisi listed dirtiness as among the various insignia of holiness.

Secular power, partly persuaded by drafty castles and lack of central heating, tended to be timorous of total immersion. Queen Elizabeth I was considered unusually salubrious because she took a bath once a month "whether she need it or no." When Queen Victoria mounted the British throne in 1837, there wasn't a bathroom in Buckingham Palace. And before American nostrils quiver in hygienic scorn, let it be noted that the White House didn't boast a bathtub until Millard Fillmore's Presidency.

Benjamin Franklin was deemed a wild eccentric because he bathed regularly. And legislators of Pennsylvania, Virginia and Ohio once solemnly debated bills to ban baths as a danger to the public health. On the word of William Allen White, editor of *The Emporia Gazette,* such hydrophobia still affected top politicos in 1896. In his famous "What's the Matter with Kansas?" editorial, White pronounced that Kansas had "an old moss-back Jacksonian who snorts and howls because there is a bathtub in the statehouse."

Meanwhile, many bathing devotees sought more from immersion than mere cleanliness. Seeking cosmetic improvement or medical cure, people have submerged themselves in mud, peat, bran, broth, guano, blood and almost every other non-corrosive mush known to chemistry. Nero's wife, Poppaea, tubbed in asses' milk. Mary Queen of Scots soaked her long body in white wine. Cora Pearl splashed about in champagne. Mrs. Porter and her daughter washed their moonlit feet in soda water.

Credit is often given to John Wesley for turning the bathroom tide when he preached that "Cleanliness is, indeed, next to godliness." If this precept turns out to be right, Heaven seems likely to be heavily populated by Americans. No other nationals are so hooked on hot water and worried about the state of foreign plumbing. Fewer sights are more sorrowful than a three-baths-a-day American, with real soap in his blood, fearfully contemplating the solitary bathroom of a British country hotel, equipped with Saxon pipework and a claw-footed, rumperoded tub, predating ancient Crete's Palace of Knossos.

Why have we all become so manic about scouring our hides in soapy water? Does it really do us any good to keep on removing our natural grease? No one has died directly of underwashing, and, as the late Ernie Pyle pointed out, "If you go long enough without a bath even the fleas will let you alone."

Perhaps we're driven to wash our bodies immoderately in symbolic expiation for having so grievously polluted our planet. Or maybe our predilection for lolling about in hot water heralds our decline just as it is supposed to have presaged the disappearance of the Roman Empire down the gurgling, inscrutable plughole of time.

I am but a lick-and-a-promise, swift shower man myself and thus not qualified to evaluate the significance of such sterility. But I leave for bathroom meditation the contention of Will Rogers that if George Washington were aroused from his tomb tomorrow and learned that the American people spend billions of dollars a year on bathing, he would ask, "What got 'em so dirty?"

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The real

Cultures which see no further than themselves bear the seeds of their own destruction.

The ideal

We must recognize that other cultures can help us as much as we could help them.

To the degree that people believe their solutions are the only ones, they begin to limit themselves and their futures.

Now, more than ever before, we have the opportunity to understand others and to profit from their knowledge. Because for the first time in history worldwide communications make it impossible for any culture to isolate itself to the degree it can believe it has all the answers.

We have some answers. Other cultures have answers to problems we face now. We must ask them to help us—as we help them.

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